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CLEANLINESS IS GOOD, BUT—

HARRY E. GORESLINE and A. WILLIAM JASPER

Production and Marketing Administration, U. S. Dept. of Agr. Washington, D.C., U.S.A.

To wash or not to wash? This has been an important topic when egg dealers talk about cold storage of dirty eggs. Now, thanks to a cooperative research project by the Production and Marketing Administration, USDA, and the National Egg Products Association, this question has been answered.

Generally, the answer is this: Dirty eggs, after washing or unwashed, should not be stored for any length of time. But, if they must be stored it is better to store them unwashed. The study also delves into the best methods of washing eggs if they are to be cleaned and stored.

Carried out under authority of the Agriculture Marketing Act of 1946 the study developed that:

1. Dirty eggs in the washed or unwashed state showed greater quality decline and loss during storage than did clean eggs.

2. Washed dirty eggs showed greater quality decline during storage than did unwashed dirty eggs. In general, dirty eggs are poor storage risks, even when washed and sanitized under the best conditions. Their greatest value lies in immediate use.

3. The quality of both washed and unwashed dirty eggs declined sharply between the second and fourth month of storage, indicating that it is not practicable to store such eggs for more than two months.

4. Oil processing retarded the rate of quality decline in all eggs, and reduced the amount of loss. Bacteria counts in the oiled eggs were much lower than in those eggs stored as "naturals."

The report reached certain definite conclusions in washing eggs.

In commercial plants many of the egg washing machines were not operated in accordance with the manufacturer's directions. This accounted, in many cases, for the poor performance of the machines.

Eggs to be washed should be handled promptly. Dirty eggs are covered with millions of bacteria, therefore high temperatures, damp packing material, and long-time holding contri-

bute to the contamination of the liquid egg inside the shell.

Pre-soak dirty eggs for a short time, either using a strong water spray or by submerging in water containing a detergent. This softens the dirt and facilitates its removal. The temperature of the water should be considerably higher than the temperature of the egg thererby causing an expansion of the egg's contents. This will prevent polluted water from getting into the egg.

After soaking, the eggs should be promptly transferred to the washing machine and washed in water as warm or warmer than that used to pre-soak the eggs. If cold water is used or wet dirty eggs are allowed to cool there will be a contraction of the egg contents which will draw contaminated material inside the shell. The study found that an adequate supply of thermostatically controlled hot water was a factor lacking in most plants.

The eggs should be cleaned with a mechanical washing unit that employs a scrubbing or brushing action. This insures adequate removal of dirt from the surface of the egg. If a detergent or detergent-sanitizer is used, it is essential that a periodic check of the concentration be made.

After washing, the eggs should be rinsed, dipped or sprayed with hot water containing a germicidal solution. The temperature of the water should be at least equal to that used in the washing operation. Frequent checks should be made to insure that the sanitizing element is in the proper concentration. The eggs should be rinsed following this sanitizing process.

The cleaned eggs should be thoroughly dried, either in a hot air dryer or by an electric fan, before they are handled or cased.

Eggs should be candled after they are washed. It is impossible to candle dirty eggs properly. All eggs showing signs of being inedible and those of doubtful value should be discarded.

If they are to be marketed, the washed eggs should be moved promptly, in new, dry packing material, with particular attention given to temperature and handling conditions. For frozen egg production, such eggs also should be handled promptly, and by experienced personnel. Eggs with even a slight odor or cloudy appearance should be discarded since they are likely to have a high bacteria count. (Marketing activities, August 1952, U. S. Dept. of Agr.

EFFECT OF NUTRITION ON QUALITY OF POULTRY MEAT AND EGGS

GEORGE F. STEWART

Poultry Department, University of California, Berkeley, Calif., U.S.A.

Over the years poultry nutritionists have emphasized the effects of feed on such things as weight gains, feed efficiency, egg production, and hatchability. To be sure these are important considerations; small differences have significant economic implications. None the less since eggs and meat are "protective" foods and since they are foods of high acceptability, their quality is of great concern to all of us. In this presentation we shall summarize the available information relating poultry nutrition to quality of product.

For our purposes quality may be defined in terms of: a) freedom from defects, b) organoleptic characteristics (color, odor, flavor, texture, etc.) and c) nutritive value. The first two of these determine whether or not the food will be eaten; the last, of course, relates to the actual content of nutrients in the product. To my way of thinking it takes all three of these to make quality.

First let us see what defects in eggs and poultry meat are affected by diet. Perhaps one of the outstanding examples is that arising out of the feeding of cottonseed oil meal to laying hens. If more than 5% of this protein concentrate is included in the ration, pink whites, olive green yolks and other defects are noted. Unfortunately these effects are not always noticed in the fresh egg. They usually develop during storage, causing serious financial losses to egg handlers. It has been claimed recently that treating the meal with certain iron compounds and extraction with isopropanol eliminates the problem. California will undoubtedly be one of the leading cotton producers of the future. This fact should stimulate us to find practical ways of using more of this protein supplement. More research and development is needed.

Almost all of you will remember the difficulty we used to experience with fishy turkeys. We now know that this was caused by feeding fish products too long. The common practice now is to remove these products from the ration at about twenty weeks of age. This practice is predicated on marketing them at 24 to 28 weeks. With the trend toward turkey broilers (marketed at 14 to 18 weeks) one wonders whether the removal of fish products should not be started

earlier than 20 weeks for this class of stock. Parenthetically it is interesting to note that chickens do not seem to be as susceptible to fishiness. In fact, it is very difficult to produce this defect in chickens.

Another example of a quality defect resulting from the diet relates to the feeding of pimento waste and grass silage. Both of these feedstuffs give rise to off-colors in the yolk. They should be avoided in laying rations. Although not ordinarily considered a feed for poultry, acorns have been found also to produce similar effects.

There are other examples of this problem. We need not dwell on them longer however except to suggest caution in the use of new or untried feedstuffs. Trials should be made to determine whether or not the material in question will cause trouble in producing defects in the meat or eggs.

Now let us turn our attention to organoleptic characteristics. Let us always remember that consumers have definite preferences for color, flavor, odor, etc. Here we are concerned with the natural characteristics and not with defects. A well known example is yolk color. Most consumers tend to prefer the lighter shades of yellowish orange. The color is under complete dietary control as most of you know. A good deal of care is usually exercised by feed mixers to maintain a constant and usually light color.

Recently we have become more conscious of skin and fat color in fryers. Here again the degree of color is under dietary control. An interesting fact, however, is that certain noncolored ingredients affect skin and fat color. For example, fish oils, fish meal, and meat scraps all tend to inhibit yellow color development. This is not only a matter of rancidity in these products; it has been shown that vitamin A itself slows up the transfer of color from the feed to the bird. A good deal of additional work is needed to clarify this problem.

One of the most dramatic effects of feed on organoleptic quality relates to the hormones. For example, dienestrol greatly improves the flavor, juiciness, and texture of fryers. In addition it bleaches the yellow color of the skin and fat. Mind you I am not recommending that this compound be fed at the present time. However, if there is no serious build-up in the edible tissues, it may be desirable to use it for improving eating quality.

While there is not sufficient information to say for sure, it seems likely that certain other feed ingredients affect flavor. Corn, for example, may be superior to oats or barley. A good deal of work needs to be done on this problem before we can

be sure. All of the cereals and their products need evaluation.

Now let us turn to nutritive value. Here again the nutrition of the bird plays a very significant role. In particular the vitamin content of meat and eggs is directly affected by dietary levels (vitamin C excepted). Specifically, vitamins A, D, E, K, thiamin, riboflavin, nicotinic acid, pantothenic acid, and folic acid have been studied.

One of the important, yet undecided questions relates to what vitamin levels should we "shoot for". Is the content which arises naturally from optimal bird nutrition adequate? What are the practical limits? These are pressing questions. Incidentally, we find that with increasing dietary levels there is a marked dropping off in the amount transferred to tissue and egg. This makes very high levels in the egg and meat generally uneconomic. A good deal of thought needs to be given to these problems. Eventually there should be some kind of minimum standards.

Generally the mineral content of the meat and eggs cannot be much influenced by diet. Exceptions include manganese and iodine. The practical significance of these two elements from egg and meat sources is not yet decided. Fluorine and selenium are also deposited in tissues and eggs in proportion to their content in the diet. Fluorine is needed in small quantities by humans; however, the need is small and larger amounts are quite toxic. Selenium is very toxic and is to be avoided in all feed ingredients.

In conclusion let me again emphasize the importance of nutrition of the bird to the quality of product. Some feeds definitely affect quality to the end that defects occur. Cottonseed meal is a prime example giving rise to olive green yolks and pink whites. Other feedstuffs affect the natural organoleptic properties of eggs and meat. A well-known example is yolk color which is under complete dietary control. Nutritive value itself is largely affected by the diet of the hen and chick particularly with respect to the vitamins.

Feed manufacturers need to give increased attention to these problems. Feeds producing defects should be eliminated or so processed as to prevent defect production. Every effort needs to be made so as to more or less standarize organoleptic quality. Color of product can probably be readily controlled. More work is needed before it will be possible to adequately control flavor, odor, texture, etc. Some minimum standards should be adapted for nutritive value, specifically for the vitamins. Only then can eggs and meats really live up to their claim of being "protective" foods.

EFFECTS OF CHILLING AND OVERHEATING OF CHICKS

C. S. SHAFFNER
Poultry Department, University of Maryland, College Park, Md., U.S.A.

In discussing the effects of various environmental temperatures on rate of growth of the chick, it must be realized that while very young the chick reacts only partly as a cold-blooded animal. That is, its body temperature can be lowered considerably without causing permanent damage. If a human is exposed to cold temperatures, the body makes a tremendous effort to maintain a uniform internal temperature. If the exposure is sufficiently severe, the alarm reactions that come into play in the body's attempt to maintain its temperature may cause more harm than the lowering of the body temperature. With a chick, the temperature regulating mechanisms are not so well developed, hence its body temperature can drop considerably without serious damage. Experiments at the Poultry Department at the University of Maryland have shown that before hatching, body temperature of the embryo can be lowered to 30 degrees F. before it is killed. After hatching, the internal body temperature can be reduced to 58 degrees F. without killing the chick, while an internal temperature of 70 degrees F. will kill the mature hen. The fact that the chick can withstand these low body temperatures is to its benefit in survival under natural conditions, since the hen often leaves the nest during hatching or the chicks become wet and chilled. It must be remembered, however, that such exposure can be tolerated for only a relatively short length of time.

With regards to high temperatures, the situation is quite different. Our experiments have shown that the chicken, whether an embryo within the shell or a mature laying hen, cannot withstand an internal temperature above 117 degrees F. Since the normal body temperature of the bird is 106 to 108 degrees F., it can readily be seen that the body temperature can be lowered considerably more than it can be raised.

Experiments were conducted at the University of Maryland in which chicks on day of hatch, when one, and when two days of age were exposed for as long as two hours to a temperature of 37 degrees F. This rather severe chilling for short periods of time was not detrimental to future growth. It is, of course, known that even mild chilling over an extended period is harmful.

Since, as pointed out above, the chick's body temperature is relatively near to its lethal temperature, it would be expected that over-heating might be harmful. This has been found to be the case. After chicks were overheated in chick boxes, they showed greater mortality and gained less rapidly than did unheated controls.

It is thus apparent that the chick is much more adversely affected by short periods of exposure to high temperatures than by exposure to low temperatures.

CHILEAN POULTRYMEN SEEK PERMISSION TO EXPORT EGGS

Faced with an estimated surplus of 20 thousand to 30 thousand cases of eggs this spring (September-November) and a domestic price claimed to be under production costs, the Assembly of Poultrymen, an association of about 95 producers in Santiago Province of Chile is endeavoring to obtain Government permits for the prompt exportation of 8 thousand cases, according to Sidney Milliken, Assistant Agricultural Attache, American Embassy, Santiago.

Applications for licenses to export this quantity were submitted before September 10 at prices ranging from US $12 to $16 per case. Shipments would be earmarked for Germany, Panama, Curacao and Peru.

About 4 thousand cases were exported in 1951, somewhat less than were licensed for export that year, but exports shortly before the war ranged 15 thousand to 20 thousand cases annually, according to the Assembly, at a time when domestic production was considerably smaller.

The Assembly has been organized to awaken the country to the importance of the poultry industry and its products and otherwise to supplement the work of the national Chilean Association of Poultrymen. It maintains that a poultry industry, developed to take advantage of export markets, should have a stabilizing effect on domestic consumption and prices. Ample public and private space is available for egg storage. The Assembly is currently carrying out a promotion program to gradually expand Chilean consumption of eggs.—"Foreign Crops and Markets" U.S. Department of Agriculture.

HYBRID VIGOR IN ANIMAL PRODUCTION

F. B. HUTT
Cornell University, Ithaca, N. Y., U.S.A.

Hybrid vigor can be defined in general terms as the extra vigor, exceeding that of both parent stocks, which is frequently shown by hybrids from the crossing of such genetically dissimilar parents as different species, breeds, strains, or inbred line. It may be expressed as more rapid growth, larger size, increased productivity, greater viability, or in other ways.

Perhaps the most familiar example of hybrid vigor in domestic animals is provided by the mule. That worthy animal, although usually deprived of any hope of posterity by the incompatibility of its maternal and paternal chromosomes, is famous for its hardiness, and capacity for work. Moreover, it is said to be endowed with a superior intelligence which tells the mule when to stop stuffing its stomach—a valuable bit of perspicacity not always found in some species that considerably outrank the mules on the zoological scale.

Hybrid vigor, however, is not a property peculiar to the offspring of two different species. In a few exceptional cases it has been found to result from heterozygosity in a single pair of allelic genes. In agriculture the best illustration of hybrid vigor resulting from suitable crosses within one species is provided by hybrid corn, which now grows on over 75 per cent of the annual acreage of that grain in the United States. For the Corn Belt alone, the corresponding figure is almost 95 per cent. Twenty years ago hybrid corn was grown on less than 0.1 per cent of the county's total corn acreage. Its rapid rise in popularity has resulted from the greater yields induced by the vigor of the highly productive hybrids that have been developed by the corn breeders.

The hybrid maize and the hybrid mule owe their superior performance to the fact, in each case, that one parent differed greatly from the other in its complement of genes. In general, the greater the genetic dissimilarity of the two parents the more pronounced is the hybrid vigor likely to be. Crosses between different breeds are more likely to show hybrid vigor than crosses between strains or families within a breed. However, the process of inbreeding can induce among inbred lines genetic differences even greater than those which differentiate breeds. It is by crossing suitable inbred lines that the corn breeders achieve their remarkable results.

Let us now consider some of the diverse ways in which hybrid vigor can be utilized to advantage in animal production. In the time available it will be impossible to survey the whole field, and I shall have to limit my discussion to a few illustrative examples.

GROWTH

It has been shown by Warren,[9,10] Bice and Tower,[1] Knox[7] and others that hybrid chicks from the crossing of two breeds of fowls usually grow more rapidly up to 10 or 12 weeks of age than do purebred chicks of the parent stocks. General recognition of this fact has increased the popularity of crossbreds as broilers and at the present time there is a great deal of interest on the part of broiler raisers in testing crosses of various breeds and strains to find which ones are most conducive to rapid growth. Such testing is necessary because it is not every cross that shows hybrid vigor. Among 11 crosses between various breeds tested by Horlacher *et al.*,[3] in 3 cases the hybrids weighed at 10 weeks less than the birds of the parent breeds, in 4 crosses the hybrids differed little from the parent stock, but in 4 others they were significantly heavier.

Similarly hybrid vigor resulting from suitable interbreed crosses in swine has been shown to accelerate the rate of growth in that species. In extensive studies by Winters *et al.*,[11] cross-bred pigs reached the desired market weight of 220 lbs. no less than 17 days sooner than pigs of the parent stocks. These were various first crosses between Poland Chinas, Duroc Jerseys and Chester Whites. When the F_1 hybrids from two of these breeds were mated to the third breed to produce a three-breed cross, the latter grew just as rapidly as the F_1 generation (Table 1). However, such remarkable results are not to be expected in every cross. Among 9 such trials reviewed by Carroll and Roberts,[2] the crossbreds failed in 4 cases to gain at a more rapid rate than the better purebred parent.

Similar acceleration of growth in hybrid beef cattle was observed by Knapp *et al.*,[6] who compared 57 Shorthorn X Hereford crossbred steers with 67 purebred Herefords. In one year when the concentrate ration was inadequate, the hybrids excelled the purebreds in gain per day in the feed lot by only 0.09 lb. per steer. However in the next year, when similar animals were given good feed *ad libitum*, the hybrids excelled the purebreds by 0.27 lb. per day.

TABLE I

Hybrid vigor in swine

	Pure breeds	First cross	cross 3-breed
Sows, no.	76	45	24
Pigs, no.	715	440	245
Live pigs per litter, no.	8.26	9.22	9.88
Litter size at weaning, no.	5.54	5.95	8.71
Days to 220 lbs.	x	x-17	x-17
Lbs. feed per pig, to 220 lbs.	y	y-28	y-36

UTILIZATION OF FEED

Feed manufacturers and nutritionists, who are accustomed to thinking solely of improving the efficiency of the diets they compound by putting into them every last vitamin and calorie that might be helpful, should reflect occasionally that much can also be accomplished by improving the efficiency of the converter, whether broiler, pig, or calf, into which that diet is eventually poured. In every instance of faster growth of hybrids cited above, that extra gain was made—not at the expense of proportionately more feed—but by more efficient utilization of feed on the part of the crossbreds.

In 10 of the 11 crosses grown by Horlacher *et al.*,[3] for broilers, the hybrids required less feed per pound of gain than did comparable broilers of the pure parent breeds. The Minnesota crossbred pigs not only went to market 17 days earlier than the purebreds, but their feed consumption to make the 220-lb. weight was 28 lbs. per pig less for one lot of hybrids and 36 lbs. less for the other (Table 1).

While better utilization of feed is one manifestation of hybrid vigor, it does not follow that to get more efficient utilization we must have hybrids. During the past decade evidence has accumulated to show that at least in fowls, turkeys, swine and beef cattle there are genetic differences in efficiency of utilization of feed, just as there are genetic differences in nutritional requirements. It seems possible that by proper selection strains of these species can be developed which would be unusually valuable, not only for their own ability to utilize feed more efficiently than most animals now do, but also for crossing to produce even better hybrids.

VIABILITY

In most studies of crossbred poultry, there is general agreement that viability of the hybrids excels that of com-

parable purebreds in early life. As this field has been reviewed elsewhere (Hutt[4]), it will suffice here to say that hatchability (of eggs from which the crossbreds hatch) is raised by 5 to 20 per cent in most crosses between breeds, and that viability is also improved (but to a much lesser degree) up to 3 months of age or more. There is still some doubt whether the viability of adult hybrids is any better than that of purebreds, and there are even indications that crossbreds which show remarkable hybrid vigor in most respects may be more susceptible to leucosis than comparable purebreds (Hutt and Cole[5]).

In other species the relation of crossbreeding to viability is even less clear. From a review of various experiments, Carroll and Roberts[2] concluded that inter-breed crosses with swine yielded no larger litters, and that post-natal viability of crossbreds did not excel that of purebreds. It seems doubtful, however, that all of the crosses considered by them were adequately controlled, and in any case there is no assurance that they were all accompanied by other signs of hybrid vigor. It is worth noting that in the extensive data of Winters *et al.*,[11] the crossbred litters were larger by 0.96 and 1.62 pigs per litter at birth and were correspondingly larger at weaning (Table 1).

PRODUCTIVITY

Evidence is accumulating to show that in suitable crosses yielding hybrid vigor the productivity of the adult crossbreds may be raised substantially over that of the parent stocks.

This was nicely illustrated in two years' experiments at Cornell in which reciprocal crosses were made between our C and K strains of White Leghorns. By making semi-diallel matings in which each male was mated concurrently with hens of his own strain and hens of the other, genetic variability was somewhat reduced and it was possible to compare each sire's hybrid daughters with their purebred half sisters. As the experiments have been reported in detail elsewhere,[5] it will suffice to show here only the results with respect to egg production, size of egg and size of bird. These are given separately for each for the 9 sire-families in Table 2.

In this table, to facilitate comparisons, the figures for the hybrids are shown only as the differences (plus or minus) from the corresponding figures for their purebred half sisters. Averages for all 9 families show that the hybrids began laying about 5 days earlier and laid 22 eggs per bird more than the purebreds. Moreover their eggs were larger by 2 grams (almost 1 ounce per dozen) and the hybrids weighed at maturity

130 grams per bird more than their purebred half sisters from the same sire.

TABLE II

Average productivity and size in purebred and hybrid daughters of nine different sires.

Year and Male	Days to first egg, number		Eggs to 500 days, number		Weight of egg, grams		Weight of bird, grams	
	Pure	Hybrid	Pure	Hybrid	Pure	Hybrid	Pure	Hybrid
1948 K-1	191	— 9	179	+29	59.8	+0.9	1,921	+ 68
" K-2	183	—10	171	+21	59.8	—0.6	2.068	+ 8
" C-1	176	— 4	205	—12	59.4	+0.5	1,925	+102
" C-2	177	— 3	183	+34	59.8	+3.4	1,990	+190
" C-3	180	— 8	203	+11	59.6	+1.6	1.978	+231
1949 K-3	190	— 7	178	+36	60.1	+3.1	2.057	+202
" K-4	182	— 2	181	+ 2	59.8	+3.0	2,174	+ 58
" C-4	180	+ 1	209	+16	59.6	+1.1	2,090	+156
" C-5	173	— 3	188	+58	56.4	+4.7	1,969	+157
Average difference		— 5		+22		+2.0		+130

The remarkable consistency of the minus signs in the first column of Table 2, and of the plus signs in the others, shows that the influence of hybrid vigor on productivity was highly significant in all of these 9 families. Hybrid vigor from the crossing of different breeds of fowls has been reported by others, but it was somewhat surprising to us to find such remarkable hybrid vigor resulting from the crossing of two strains of the same breed, neither of which was highly inbred.

Evidence that hybrid vigor can be similarly effective in raising milk production in cattle is accumulating from experiments that have been carried out for some years by the U. S. Department of Agriculture at Beltsville. In various crosses between Holsteins, Jerseys, Guernseys, and Red Danes, Fohrman found that the milk production of 32 crossbred heifers was 20 per cent higher than that expected without benefit of hybrid vigor. From these remarkable results and others from the same experiments, it seems probable that the genes for production of milk and of butterfat which have been accumulated in our pure breeds by generations of good cattle breeders may be made even more useful when they are recombined in suitable crosses of the highly improved pure breeds.

BREEDING FOR HYBRID VIGOR

Let no one suppose that hybrid vigor is to be found in each and every cross of breeds, strains or inbred lines. Almost every report of exceptional hybrid vigor in domestic animals

can be matched by records of crosses in which little or none was evident. The problem of geneticists and animal breeders is to find what kinds of crosses, and what kinds of breeds, strains, and individuals, are most likely to yield a profitable degree of hybrid vigor. Such studies are complicated by the fact that geneticists are not yet in agreement about the genetic basis for hybrid vigor.

A theory long favored is that hybrids between inbred lines (or breeds, strains, or species) are less likely than either parent to have deleterious recessive genes in their homozygous effective condition. In the heterozygous hybrids such genes could exert little or no ill effect. Another theory is that the heterozygous state is more conductive to vigor than is homozygosity for either the dominant or recessive gene of a pair of alleles. This view, which was advanced by Shull over 40 years ago, was labelled as the theory of *heterosis* and this term has since become a synonym for hybrid vigor. While these two theories do not agree on the reasons why heterozygotes are more vigorous than homozygotes, they do agree on the fact that the vigor of hybrids is directly proportional to the degree of their heterozygosity. This is another way of saying that parents widely dissimilar in genetic constitution are more likely to show hybrid vigor in their offspring than are parents more closely related.

The problem of animal breeders is how to get the maximum of heterozygosity. The corn breeders do it by developing highly inbred lines, crossing these in pairs, and then crossing the F_1 hybrids to produce the so-called double-crossed hybrids, but this method is less suitable for animals than for plants. It takes 20 generations of brother X sister matings with animals to yield the degree of inbreeding that results from only 10 generations of self-fertilization in corn.

For this reason, and the added fact that close inbreeding in animals frequently leads to disaster, animal breeders are more interested in testing to see what existing breeds and strains are most suitable for crossing to yield hybrid vigor. If the theories of some statistical geneticists be correct, it may be possible to develop better strains for crossing by selecting breeding stock according to its ability to combine with other lines, rather than for its ability to improve its own line. Evidence on that score is still awaited. It is also possible, as our crosses of the C and K strains of Leghorn have shown, to get hybrid vigor by crossing strains within a breed, even though such strains are not highly bred.

Another interesting development has been that, contrary to earlier recommendations, the F_1 hybrids between different breeds need not be discarded when their productive life is past. With fowls, swine, and dairy cattle, evidence is accumulating to show that these hybrids may be crossed with a third breed to produce three-breed crosses that are just as vigorous as the others, or more so.

Ways and means of identifying and developing breeds, strains, and families most suitable for crossing are now being sought by numerous investigators. It seems probable that the application of their findings will eventually enhance greatly the productivity of domestic animals.

REFERENCES

1. Bice, C. M. and B. A. Tower. Hawaii Agr. Exp. Sta. Bull. 81, 1939.
2. Carroll, W. E. and E. Roberts Illinois Agr. Expt. Sta. Bull. 489. 1942.
3. Horlacher, W. R., R. M. Smith and W. H. Wiley. Arkansas Agr. Expt. Sta. Bull. 411. 1941.
4. Hutt, F. B. Genetics of the Fowl. New York. McGraw-Hill. 1949.
5. Hutt, F. B. and R. K. Cole. Poul. Sci., *31:* 365. 1952.
6. Knapp, B., A. L. Baker and R. T. Clark. U.S. Dept. Agr. Circ. 810. 1949.
7. Knox, C. M., J. P. Quinn and A. B. Godfrey. Poul. Sci., *22:* 83. 1943.
8. Fohrman, M. H. U.S. Dept. Agr. Mimeographed Report BDIM-Inf.-30. 1946.
9. Warren, D. C. Poul. Sci., *7:* 1. 1927.
10. Warren, D. C. Kansas Agr. Exp. Sta. Bull. 52. 1942.
11. Winters, L. M., O. M. Kiser, P. S. Jordan and W. H. Peters. Minnesota Agr. Exp. Sta. Bull. 320. 1935.

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THE TEN LEADING EGG-PRODUCING COUNTRIES

World egg-production data of 48 different countries, not including the U.S.S.R. and its satellites, were published recently by the Office of Foreign Agricultural Relations of the United States Department of Agriculture. Based on the total of approximately 113 billion eggs produced in 1951, the following ten countries were the most important ones, the figure after each country indicating that country's production as a percentage of the total production: United States, 51.7; France, 6.6; United Kingdom, 5.4; Italy, 4.4; Western Germany, 3.6; Canada, 3.2; Brazil, 2.9; Argentina, 2.4; Denmark, 1.9; Belgium, 1.5. These ten countries were responsible for over 83 percent of the total production of the 48 countries. —Morley A. Jull.

EFFECTS OF AUREOMYCIN ON TURKEY SINUSITIS

D. W. FRANCIS

University of Delaware Sub-station, Newark, Del., U.S.A.

Antibiotics have been used for treating many diseases, with various results. One antibiotic may be effective against an organism, whereas, others give poor results. Workers at the Virginia Experiment Station have shown streptomycin to be effective against the sinusitis organism, while penicillin has had no effect at all.

In August of 1950 two reports appeared—stating that the injection of 25-50 mg. of Aureomycin into the affected sinuses relieved the sinusitis, but the air sac infection did not seem to be affected. Intramuscular injections of 100 mg. of Aureomycin had no apparent effect on the involved sinuses. Repeated injections were not effective in eliminating the sinusitis or the air sac infection. Injections into the sinuses, although of benefit to the sinusitis, did not help those affected with the lower form of disease. This form is characterized by thickened air sac membranes, pus over the membranes, pneumonia. It occurs consistently in both treated and untreated birds.

During the summer of 1950 one half of the turkey flock at the University of Delaware Substation received 5 lbs. of an APF supplement and 100 grams (approximately 3.5 ounces) of Aureomycin (Commercial Aurofac) per ton of feed. When the poults were four or five weeks old, it was observed that the pens receiving Aureomycin showed no symptoms, while the other group developed symptoms of sinusitis which were present throughout the experiment. The affected birds were treated individually with injections of Aureomycin as the sinusitis showed up. Observations made on a small sample of each group when killed, showed an absence of any sinusitis or air sac infection in the pens receiving Aureomycin. How-

TABLE I

Effect of Feeding Aureomycin on Sinusitis

	Group 1 APF 5 lbs.— 100 gms. Aureomycin	Group 2 No Treatment
Number of Birds	303	303
Average Weight	16.1	15.1
Per Cent Mortality	9.9	20.13
Feed Efficiency	3.38	3.56
Sinusitis symptoms	None	All Pens

ever, the sample coming from the untreated group showed typical sinusitis and air sac infection.

These preliminary results indicate the use of Aureomycin to control one of the most important diseases of turkeys. At the same time it may have added value as a growth stimulant, improving feed efficiency and controlling mortality in turkey flocks.

Further work is underway at the University of Delaware Substation to study the effect of Aureomycin on sinusitis and to determine the most effective level of use.

TOM NEWMAN MEMORIAL AWARD

This International Award which was initiated by the Poultry Association of Great Britain and is given for what is considered by the Award Committee in the United Kingdom to be the most important contribution in poultry husbandry research work published in the previous year for the benefit of poultry husbandry, has been made this year, for work published in 1951, to Dr. C. Horton-Smith of the Animal Health Trust. The three previous awards have gone to American research workers. The Award consists of a gold medal and a prize of £50.

Dr. C. Horton-Smith is an eminent parasitologist who has specialized in studying internal parasites in poultry. From 1937 to 1951, the whole of his time has been devoted to the study of the *Eimeria* species of coccidia, with particular reference to the epidemiology, immunology and chemotherapy of the disease as it occurs in chicks. On various aspects of this work he has published some 30 scientific papers.

Dr. Horton-Smith was one of the originators of the use of sulphonamides in the treatment of coccidiosis in poultry and was responsible for the development of sulphamezathine in this respect. A point of much importance in his work has been that coccidia-infected chicks develop an immunity to further infections with the same species of the parasite during the period of treatment with sulphonamides. Studies have also been made on the toxicity from over-dosage or prolonged treatment and on the use of ammonia as a disinfectant for coccidia.

Dr. Horton-Smith's work and that of his colleagues during the past year has confirmed American findings and has established in Great Britain the value of sulphaquinoxaline in the treatment and control of coccidiosis at levels consider-

ably below those used for sulphamezathine. Recent investigations have also shown that nitrofurazone is a drug of considerable promise. These observations are of considerable interest since these two drugs are outside the sulphonamide range previously used.

During the past year he has also studied the pathogenic role of *Histomonas* and its relationship to *Heterakis*, the caecal worm, in the production of blackhead in turkeys. This work has also included a study of the pathogenic status of other organisms found in turkeys such as *Chilomastix*, *Blastocystis* and *Trichomonas*. Investigations are in progress on the chemotherapy of the disease. Work has also been carried out on the value of an organic mercurial compound in the *in vitro* control of moniliasis and aspergillosis.

The work published by Dr. Horton-Smith in 1951 dealt with:

(a) Enheptin-T in the Treatment of Histomoniasis (Blackhead) in Turkeys.
(b) Sulphaquinoxaline in the Treatment of Caecal Coccidiosis in Chickens.
(c) Sulphonamides and Caecal Coccidiosis in Chickens.

The Rt. Hon. The Lord Mayor of London (Sir Leslie Boyce, K.B.E., J.P.) presenting the Tom Newman Memorial Award to Dr. C. Horton-Smith, B.Sc., D.I.C.

INDICATED 1952 WORLD EGG PRODUCTION

The production of eggs in 1952 in a group of countries for which estimates are available is indicated at approximately 3 percent greater than that of a year earlier but 55 percent greater than the prewar, 1934-38 average.[1] Most of the increase, compared with 1951 and prewar, is accounted for by increases in Canada and in the United States but significant increases also are indicated in Western Germany and Sweden. In other reporting European countries 1952 production is expected to be about the same or slightly smaller than in 1951. Increases over prewar are indicated in all reporting European countries excepting Ireland.

The indicated increase in egg production in the major countries reporting an increase, is mainly the result of an increase in the number of hens and pullets, although there has been an increase in the rate of lay in a number of reporting countries. In countries where feed is relatively plentiful except for the United States, higher egg prices, reflecting in large part an increase in demand, have stimulated egg production. In most European and South American countries, however, the short supply and relatively high price of feed has retarded any further increase or caused some decline in egg production. In many feed-importing countries Government policy has been directed toward stabilizing flocks at a level that can be supported mainly with locally grown feeds.

Egg production in *North American* countries in 1952 is expected to be greater than that of a year earlier mainly as a result of increases in the United States and Canadian production. A combined increase over prewar of over 70 percent is indicated for these 2 countries. Sharply increased numbers of pullets on farms at the beginning of 1952 was an important factor in both countries. Commercial egg production is believed to be increasing in Mexico and in Cuba under encouragement from the Cuban Ministry of Agriculture.

Egg production in reporting countries of *Europe* is expected to show a slight increase in 1952 over that of a year earlier mainly as a result of increased production in Western Germany. A moderate increase also is indicated for Sweden. Production is expected to be about the same, or slightly smaller, than that of a year earlier in Belgium, Denmark, Ire-

[1] United States, Canada, Belgium, Denmark, Western Germany, Ireland, Sweden, Switzerland and the United Kingdom. The comparison with 1951 includes estimates for Argentina, Brazil and Chile, for which no prewar data are available.

land and Switzerland. Decreased production in the United Kingdom is expected to represent the greatest decline in any European country for which data are available.

Egg production in *South America* is expected to be greater than that of a year earlier as a result of increases in Argentina, Brazil and Chile, the 3 principal egg producing countries. Higher egg prices than a year earlier has been an important factor in this increase, and improved production and marketing pactices in Brazil and Chile are also stimulating some increase. The scarcity and high prices for feed grains is serving to retard the rate of increase in most Latin American countries, however. A decline is indicated in Uruguay as a result of some liquidation in flocks, the result of high prices for both meat and corn.

In *Asia*, estimates of 1952 production are available only for Israel and Pakistan. Some decline is anticipated in Israel's production as a result of feed shortage and a reduction in laying hens, while some increase is expected in the latter country as a result of some further development of the poultry industry in East Bengal, this country's most important producing area.

United States farm production of eggs in 1952 is expected to be moderately greater than that of a year earlier as the combined result of a slight increase in the average number of layers and in the average rate of lay. The 3.2 percent increase in production during the first 8 months is expected to be fairly indicative of the increase for the year as a whole. Although 1952 production is expected to be the greatest on record, the sharply reduced number of chicks and young pullets on September 1 implies some decrease in egg production at least in the first half of 1953.

In *Canada*, 1952 egg production on farms is expected to exceed the 1951 total by 12 to 15 percent. Production in the first 6 months was about 18 percent greater than a year earlier as a result of the unusually large hatch in 1951 and is expected to continue greater during the last half of 1952. Although the total number of chicks hatched in 1952 was 6 percent less than a year earlier, the proportion of early-hatched pullets was greater. Egg prices have been considerably lower than a year earlier and both domestic consumption and exports have been somewhat greater. The United States continues to be the principal export market.

In *Austria* the rate of increase in egg production is expected to be retarded by the continued shortage and high price of feed grains and protein concentrates, although a gradual

recovery to prewar levels is anticipated mainly as a result of a program to replace inferior layers with imported laying breeds.

In *Belgium* the high cost of poultry feed, much of which is imported has tended to offset advances in egg prices and little or no increase in egg production in 1952 over the 1951 rate is indicated.

In *Denmark* a slight decline in 1952 egg production is expected as a result of a decrease in the average number of laying hens on farms during the year. The new United Kingdom-Denmark egg contract, announced August 8, extended the prices and other terms of the trade agreement for another year (September 30, 1953). It has been considered satisfactory to Denmark poultry producers since there has been some increase in the supply of feed grains and some reduction in cost compared with 1951. The reported increase in the number of young birds suggests some recovery in egg production in 1953.

An indicated increase of 6 percent in 1952 production over that in 1951 in *Western Germany* accounts for most of the reported increase in Western Europe. This increase has been due mainly to the larger number of mature hens. Higher egg prices, largely the result of an increase in the import duty and in the general level of egg prices in Western Europe have been important in inducing this increase. Western Germany continues to import a significant though decreasing part of its egg supply, with the bulk coming from the Netherlands, Denmark and Sweden.

In *Ireland* egg production increased over a year earlier in the first quarter of 1952 as a result of favorable weather and adequate feedstuffs, in spite of a decline in the number of layers. For the year as a whole, however, egg production is expected to decrease slightly. The Government is encouraging increased production of poultry meat to take advantage of domestic and British markets.

In the *Netherlands* a sharp drop in layer numbers in crease in egg production during the first 6 months of 1952. early 1952, due to extensive culling, resulted in a slight de-Although there recently has been an increase of egg prices to levels above last year and some improvement in the outlook for exports, the total production of eggs in 1952 probably will be slightly less than a year earlier.

In *Sweden*, an increase in the number of young layers and in the reported rate of lay per bird, stimulated by good prices and an expanding domestic market, is expected to result in a new record in egg production in 1952.

EGGS

Number produced in specified countries, average 1934-38, annual 1947-51 and indicated 1952[1]

Continent and country	Average 1934-38	1947	1948	1949	1950	1951	Indicated 1952
	Million	Million	Million	Million	Million	Million	Million
North America							
Canada	2,638	4,484	4,274	3,774	3,662	3,611	4,050
United States—Farm	35,498	55,384	54,899	56,154	58,734	59,356	61,400
Cuba	320	288	276	318	320	——	——
Dominican Republic	——	60	60	60	60	60	——
Guatemala	——	——	——	——	90	——	——
Panama	——	52	——	54	——	55	——
Europe							
Austria	663	285	350	400	540	640	——
Belgium	1,693	1,380	1,440	1,900	2,100	1,945	1,945
Denmark	1,979	992	1,392	1,870	2,120	1,960	1,940
Finland	317	117	176	266	317	340	——
France	6,200	6,300	6,100	6,800	7,500	7,500	——
Germany (Western)	4,500	1,975	2,250	2,800	4,100	4,900	5,200
Greece	550	376	384	390	440	423	——
Ireland	1,086	733	844	1,014	1,073	855	850
Italy	5,500	4,300	4,450	4,550	5,000	5,225	——
Luxembourg	40	30	35	40	40	40	——
Netherlands	1,978	1,052	1,159	1,480	1,775	2,075	——
Norway	369	198	263	340	459	391	——
Portugal	250	——	——	——	450	450	450
Spain	1,700	1,992	1,800	1,800	1,920	1,980	——
Sweden	1,000	1,217	1,335	1,331	1,407	1,392	1,427
Switzerland	423	370	430	516	520	525	522
United Kingdom:							
Farm[2]	[3]3,871	2,500	2,800	3,600	4,400	4,800	4,800
Total[2]	[3]5,098	4,230	4,440	5,300	6,160	6,500	6,300
Yugoslavia	1,000	——	——	——	——	——	——
Asia							
Lebanon	——	60	48	42	45	40	——
Israel[4]	108	——	——	163	340	400	350
Syria	92	90	110	70	90	80	——
Turkey	1,003	895	852	850	855	942	——
Japan	3,553	663	790	1,214	1,568	——	——
India	——	——	——	1,085	1,082	——	——
Pakistan	——	——	300	——	——	——	450
Philippine Islands	——	400	605	652	740	900	——
South America							
Argentina	1,127	——	——	——	2,750	3,000	3,100
Brazil	——	2,820	2,860	3,100	3,280	3,350	3,440
Chile	——	460	400	600	670	760	800
Paraguay	——	100	110	120	120	——	——
Uruguay	289	326	330	300	300	——	——
Africa							
Egypt	751	——	——	——	514	455	——
French Morocco	1,000	——	——	——	——	500	——
Union of S. Africa[5]	——	——	——	1,200	840	960	——
Oceania							
Australia[5]	708	1,470	1,431	1,443	1,388	1,288	——
New Zealand	430	[6]134	[6]135	[6]140	[6]170	[6]180	——

1 Relates to farm production in Canada and the United States, but data for many countries not explicit on this point. 2 Year ending May of year indicated. Numbers possibly underreported and subject to revision. 3 3 year average. 4 Year ending September 30. 5 Year ending June. 6 Commercial production for years ending June 30.

In *Switzerland*, 1952 egg production is expected to decline slightly, compared with that in 1951 as a result of a reported decline in layer numbers. Production per hen is about the same as that of a year earlier. While there is an increase in the current number of young replacements, only a gradual increase in egg production is expected in the next few years. The number of layers apparently has stabilized at around 1949 levels, while the average yield per hen, associated with some shift to commercial flocks, is gradually increasing. The relatively high cost of imported feed and low cost of imported eggs has served to discourage expansion in domestic production.

In the *United Kingdom*, 1952 production is expected to decline below that of a year earlier principally as a result of a decrease in the number of layers. Although there has been a gradual decline in the rate of lay since the war, this rate reportedly has not yet recovered to prewar levels. This has been the result of continued scarcity of imported feedstuffs, relatively more favorable hog prices and, to some extent, the government's recent policy of setting relatively low springtime egg prices to encourage a more uniform seasonal rate of production.

In *Argentina*, 1952 egg production is expected to be moderately greater than that of a year earlier. Prices have been above those of 1951 for several months and an increase in the number of hens has more than offset a slight decline in the rate of lay. Although chicken numbers are expected to remain about unchanged during the balance of the calendar year and the first half of 1953, the anticipated larger grain crop will tend to increase the yield per hen.

In *Brazil*, the production of poultry and eggs has been increasing steadily in recent years, with a shortage of grain and milling by-products the main limitation. Production in 1952 is estimated at approximately 3 percent greater than a year earlier mainly as a result of an increase in layer numbers. Prices have been good and increasing attention is being given to improved breeds and egg quality. A recent Government action removed the requirement of prior import licenses on hatching eggs and chicks. Imports have been retarded, however, by the shortage of dollar exchange. While import charges on hatching eggs amount to only a few cents a dozen, the relatively high charge on chicks, amounting to US 60-80 cents each, has retarded imports of this item.

In *Chile*, egg production in 1952 is expected to be at least 5 percent greater than in 1951, principally as a result of an

increase in the rate of lay. Feed grains have been fairly plentiful, but there has been a scarcity of fish meal. Although there has been some consumers' resistance to increasing egg prices, the industry is hoping to increase domestic consumption by stabilizing seasonal egg production through extending the hatching season.

In *Australia* preliminary data for the year ending June 30, 1952 indicate a reduction of about 6 percent as a result of the high price of feeds, largely explained by the recent drought-curtailed grain crop. No 1952 indications of egg production are available for New Zealand nor for the countries of Africa.

This is one of a series of regularly scheduled reports of world agricultural production approved by the Office of Foreign Agricultural Relations Committee on Foreign Crop and Livestock Statistics. It is based in part upon U.S. Foreign Service reports. Foreign Agriculture Circular, U.S. Dept. of Agriculture, Washington, D.C. Sept. 22, 1952.)

FACTORS AFFECTING EGG QUALITY ON FARMS

ALBERT L. OWENS

Agricultural Economics Department, University of Rhode Island, Kingston, R. I., U.S.A.

The principal breeds found on the 56 farms visited are shown in Table 1. The sex-linked Red-Rock cross was the most common single breed both in number of birds and flocks. The Rhode Island Red was second in importance. On those farms reporting mixed flocks, most of the birds were of these two breeds.

TABLE I

Size of Flocks by Breeds on 56 Rhode Island Farms, Winter and Spring, 1949.

Breed	Proportion of Farms		Average Size of Flock	
	Winter	Spring	Winter	Spring
	Percent		No. of Birds	
Sex-Link Cross	34	26	1005	1025
R. I. Red	20	18	917	747
White Ply. Rock	7	4	488	356
New Hampshire	5	7	833	575
Barred Ply. Rock	4	4	1550	1375
Mixed Flocks	30	41	964	888
Average			949	876

The flocks included in the sample ranged in size from 125 to 4000 laying birds in the winter, and from 80 to 4500 laying birds in the spring. The change in the size of flock between seasons varies greatly between farms due to differences in culling practices and in the system of housing replacements. The net effect of these two factors is reflected in the decline in the average size of flock from 949 birds in the winter to 876 birds in the spring.

HOLDING FACILITIES

Poultry specialists recommend that eggs be packed and held in egg rooms in which temperatures can be kept below 60°F with the relative humidity above 70 percent. About 70 percent of the producers visited felt that conditions in the farm cellar would not materially affect quality during the period eggs remained on the farm. Egg rooms were found on 20 percent of the farms. The remaining 10 percent reported holding eggs in various places other than in cellars or egg rooms. None of the farms surveyed had special facilities for controlling temperature and humidity.

TEMPERATURE AND HUMIDITY

Research has shown that eggs deteriorate more rapidly as holding temperatures increase. Humidity exerts more influence on quality at higher temperatures. The length of time eggs remain on farms is an important factor associated with the effect of temperature and humidity on egg quality. The farms studied reported that eggs were marketed at least once a week. None of the eggs sampled had been held more than 7 days. The average holding time was 3 to 4 days.

The temperature and relative humidity at the place eggs were held was recorded for all farms. Temperatures ranged from 40°F to 74°F in the winter and from 55°F to 74°F in the spring. No significant differences were found in the percentage of Grade A eggs on farms with temperatures below 60°F and those at or above 60°F. There was also very little difference in the percentage of Grade A eggs on farms with humidity readings above and below 70 percent. Since the temperature and humidity reading refer only to the time of the farm visit, and not to the entire period eggs were held on the farm, the failure to find significant differences at various levels cannot be construed to mean that these factors do not influence egg quality.

The average quality of eggs on all farms was somewhat higher in the winter than in the spring. In the winter, 86

percent were Grade A as compared with 76 percent in the spring. Higher or lower average temperatures between the seasons could explain some of the differences.

EGG CLEANING

Although some dirty or stained eggs are unavoidable, it is recommended that producers make every effort to produce clean marketable eggs. This is the best way to take care of the problem of dirty eggs. Insofar as possible, dirty eggs should not be washed. Dry buffing with emory paper or a similar abrasive is recommended. Washing becomes necessary when eggs are so dirty that buffing results in an unattractive or damaged shell. Where the operation is large enough to warrant purchase, machine washing seems to be most satisfactory. The type of mechanical washer which combines water vapor with nylon or bristle brushes seems to be best. Water temperature should be maintained at 130°F. For the small operator who must wash by hand, the use of a detergent with water at 130°F is recommended . The container should be large enough to cover a wire egg basket and permit sufficient movement of the eggs to maintain water circulation. After washing, eggs should be placed in a container for air drying, preferably a rubber-coated basket with a mesh bottom.

. All of the 56 farms visited reported that they cleaned eggs. Most farms used some hand method, but a combination of wet and dry methods was found on 41 percent of the farms. About 30 percent reported dry buffing as the only method, and the remaining farms washed or wiped the eggs with a wet cloth. Mechanical washers were used on two farms in the winter and four in the spring. Although all operators cleaned eggs before shipment, 1.3 percent of the winter eggs and 5.5 percent of the spring eggs were stained or dirty.

MANAGEMENT PRACTICES AND EGG QUALITY

The 6048 eggs selected in each survey were candled by a qualified grader according to U.S.D.A. Standards for individual Shell Eggs. The results of the gradings are shown in Table 2.

In each survey, the percentage of eggs Grade A and above was high. The proportion of Grade A eggs in the winter was 85.7 percent while in the spring it was 76.3 percent. Most of this decline resulted from an increase in Grade C and in stained and dirty eggs. The drop of 18.4 percent in the number of AA eggs between seasons suggests that holding temperatures above 60°F were too high to permit holding AA quality for

any lengthy period of time. Though not as large, the decline in the percentage of eggs Grade A and above is more important from the standpoint of the market grade.

In the regional study, for which these surveys were made, egg quality was related to a number of desirable management practices. The practices believed to have the greatest effect on quality were, three or more egg collections daily, exclusion of male birds, and confinement of the laying flock. It was concluded that quality measured in terms of Grade AA eggs was higher as the number of desirable practices increased. (From "Marketing Practices and Egg Quality, 1948-49" Northeast Regional Publication No. 3, Cornell University, February 1950, page 12).

Since Grade AA is of little commerical importance, comparisons of quality are more valid if they include Grade A eggs. Such comparisons are shown in Table 3.

TABLE II

Distribution of Eggs by Grades on 56 Rhode Island Farms, Winter and Spring, 1949.

Grade	Percent of Sample		Percent Change Winter To Spring
	Winter	Spring	
AA	65.4	47.0	-18.4
A	20.3	29.3	9.0
Total AA and A	85.7	76.3	- 9.4
B	5.0	6.1	1.1
C	4.7	8.1	3.4
Checks	2.9	3.5	0.6
Stains and Dirties	1.3	5.5	4.2
Leakers and Loss	0.4	0.5	0.1
Total Below A	14.3	23.7	9.4
Total All Grades	100.0	100.0	—

No significant difference in egg quality was observed on farms following any or all of the desirable management practices. It was also noted that flocks were larger on farms where a greater number of desirable practices were followed and superior management was generally associated with the larger, more specialized farms. Egg quality was apparantly influenced more by the combination of practices used than by the presence or absence of a single practice.

Two groups of farms were compared to illustrate the influence of the number of daily collections on egg quality. One group averaged over three collections daily, while the other averaged less than two collections. Both groups followed the other two management practices previously discussed.

TABLE III

Relation of Egg Quality To 3 Management Practices, 56 Rhode Island Farms, 1949.

	Period 1949	Number of Management Practices Followed		
		1	2	3
Number of Farms	Winter	8	27	21
	Spring	6	28	22
Av. Size of Flock	Winter	706	881	1127
	Spring	753	879	904
Percent of Flocks confined	Winter	38	89	100
	Spring	50	89	100
Percent of Flocks without Males	Winter	50	56	100
	Spring	53	64	100
Daily collections	Winter	1.9	2.5	3.1
	Spring	1.8	2.5	3.1
Number of eggs	Winter	864	2916	2268
	Spring	648	3024	2376
Percent of Eggs Grade A and above	Winter	85	86	87
	Spring	74	75	79

In the winter, the number of collections had little influence on the quality of the eggs. Most of the diference in the percentage of eggs Grade A and above in the spring was reflected as an increase in stains and dirties. This suggests that more frequent collections during the time when dirty eggs are a problem will help the average quality. This difference would have undoubtedly been greater had no cleaning been done by the farmer.

Before concluding that fewer daily collections caused these differences, more information is needed. To reach a valid conclusion, the conditions under which the eggs were held between collection and inspection time would have had to be the same. Other management practices which influenced the condition and appearance of the shell were the type and condition of litter, supply of nesting material, and amount of cleaning and handling. Interior quality was influenced by temperatures in the laying houses between collections and the time elapsing before eggs were cooled. These variables must be controlled before relating egg collections to interior quality loss.

FEATHER MEASUREMENTS AND EGG PRODUCTION

A. M. GERICKE and J. ERASMUS
Agricultural Research Institute, University of Pretoria, South Africa

Various methods are applied by poultrymen in estimating the productive capacity of hens. From all available evidence the pigmentation test and the time and rate of moulting gives a more reliable estimate of productive capacity than anatomical measurements. The physiological tests can only be applied after a pullet has been in production for some time. No methods are available by which the future productive capacity of a pullet can be estimated except by the breeding potentialities of her parents or her pedigrees and short time trapnest records.

In a preliminary test, the length and width of the tenth primary, first secondary and back feather was measured. These results are given in table I.

TABLE I

Feather Measurements and Egg Production

Breed	Average Production	Feather	Average Length and Width In Centimeters			
			Total Length	Quill	Shaft	Width
*W.L.	160.2	10th Primary	15.00	1.80	13.20	1.95
	126.0		16.40	1.95	14.45	1.80
*B.A.	188.0		14.45	1.77	12.68	1.87
	144.5		15.17	1.92	13.25	1.95
W.L.	160.2	1st Secondary	18.66	3.25	15.41	3.55
	126.0		18.38	3.03	15.35	3.67
B.A.	188.5		17.52	2.61	14.91	3.61
	144.5		18.60	2.85	15.75	3.80
W.L.	160.2	Back	9.24	0.65	8.59	2.57
	126.0		9.48	0.65	8.83	3.06
B.A.	188.5		12.32	0.64	11.68	2.90
	144.5		12.10	0.85	11.25	3.00

* W.L. = White Leghorn.
* B.A. = Black Australorp.

The records obtained from 6 hens in each group revealed that the 10th primary feather of high producers was slightly shorter than that of the low producers in each breed measured. The width of the first secondary and the back feather in front of the preen gland was smaller in high than low producers. The width of each feather was measured by placing it in the normal position against a sliding caliper and taking the reading at the estimated widest point. The quills of the 10th primary were also shorter in both high producing White Leghorns and Black Australorps than in low producers.

These results appeared interesting but the number of birds was too small for an estimate of egg production. The measurements compiled in table 2 include the length and width of feathers in centimetres of 76 White Leghorn hens at 18 months, 219 White Leghorn pullets at approximately 7 months and 115 Black Australorps at 8 months of age.

TABLE 2

Feather Measurements and Coefficients of Variation

Breed	Feather	Total Length cm.	C.V.	Width cm.	C.V.
W.L. Hens	1st Secondary	18.58	3.53	3.35	8.06
	4th Primary	20.81	3.02	2.74	13.69
	10th Primary	15.44	5.63	1.89	11.59
	Back.	7.50	19.52	3.11	14.63
W.L. Pullets	10th Primary	15.70	2.86	1.86	6.34
	Middle tail.	19.80	4.78	2.90	9.69
	Back.	4.90	7.61	2.41	15.29
B.A. Pullets	10th Primary	13.29	6.78	1.83	7.79
	Middle tail.	17.38	7.31	3.30	8.84

Greater variation was obtained in the length and width of the back feather than in the other feathers measured. In general the variation in width was greater than in length. The variation in the back feather could partly be attributed to more wear and tear in this feather as it is normally of a finer texture than those of the wing and main tail. Sometimes the tip is worn off and it is difficult to determine exactly where the measurement should be made. This also applied in a minor degree to other feathers depending upon the period of egg production.

Additional evidence was obtained by calculating the correlation coefficients between the total length of feathers and the length of the quill and shaft. The correlation coefficients calculated from the feather measurements of 76 White Leghorn hens are given in table 3.

TABLE III

Correlation Coefficients Between Length of Feathers and Length of Quill and Shaft.

	Average Length cm.	Length of Quill cm.	Length of Shaft cm.	Correlation Coefficients: Average Length and Quill	Correlation Coefficients: Average Length and Shaft
4th Primary	20.81	3.85	16.96	0.35	0.84
10th Primary	15.44	1.73	13.71	0.17	0.98
1st Secondary	18.58	3.13	15.45	0.46	0.93
Back Feather	7.50	0.55	6.95	0.40	1.00

Highly significant positive correlation coefficients were obtained between the length of feathers and the length of the shaft or rachis but between the length and the quill the coefficients were of a lower magnitude. Between the length of the tenth primary and the quill the coefficient was not significant at P = 0.05. The correlation analysis indicated fairly definitely that the length of the shaft was a good measurement of the length of the feather and the quill need not necessarily be included. The shaft can be measured on the body of the bird and the feather need not be plucked.

In subsequent tests, measurements were made of the feathers of 82 White Leghorn hens in the first laying year. These birds were divided into two groups representing group A as those individuals which laid 72 or more eggs and group B as those which laid less than 72 eggs in the first six months. At the end of 6 months the low producers were culled and no further trapnest records of these individuals were kept. The results are given in table 4.

TABLE IV

Feather Measurements, Production and Body Weight

Group	Eggs	Live Wt. gm.	Feather	Average Length	Width of Feather
A	95.7	1964	1st Secondary	18.54	3.39
			4th Primary	20.83	2.77
			10th Primary	15.46	1.96
			Back Feather	7.45	3.11
B	43.8	1844	1st Secondary	18.36	3.50
			4th Primary	20.78	2.88
			10th Primary	15.48	1.94
			Back Feather	9.31	3.09

From the average measurements the following deductions were made:

(i) The length of the back feather was greater in low than high egg producers.

(ii) The width of the first secondary and the fourth primary was greater in low than high producers.

(iii) Between the high and low producers there was practically no difference in the length and width of the tenth primary.

In a subsequent test, measurements were made of the feathers of White Leghorn pullets which were hatched on the same date and they were 10 months and 18 days of age when their feathers were measured. From day-old and until the feathers were measured no selection was applied. The birds were divided into three groups according to the length of the

shaft of the tenth primary and the width of the back feather in front of the preen gland. They were kept in adjacent houses under exactly the same conditions of housing, feeding and management.

Group I consisted of 25 pullets with the tenth primary shaft under 14.3 centimeters in length and the width of the back feather under 3 centimeters.

Group II consisted of 23 pullets with feather measurements different from those in groups I and III.

Group III consisted of 27 pullets with the shaft of the tenth primary under 14.3 centimeters and the width of the back feather above 3 centimeters.

Details of the mean measurements of the feathers, body weight and egg production for the first 10 months of the first laying year are given in tables 5 and 6.

TABLE V

Body Weight, Feather Measurements and Egg Production

Group	Body Weight gm.	Length of Shaft 10th Primary cm.	Width of Back Feather cm.	Egg Production per Hen
1	1674.6	13.64	2.92	167.8
2	1794.7	14.63	3.61	149.4
3	1696.0	13.54	3.44	140.0

TABLE 6

Subclasses of Birds in Group 2 (Table 5)

Subclasses	No. of Birds	Length of Shaft 10th Primary cm.	Width of Back Feather cm.	Egg Production per Hen
A	6	15.10	3.83	160.0
B	8	14.52	3.76	143.7
C	3	14.60	2.80	160.5
D	3	14.60	3.00	166.5
E	3	14.00	4.20	115.0

The average egg production was obtained by taking the trapnest records of each group into account. In egg production the birds were grouped in the following order of merit :

First—Short shaft of tenth primary and narrow back feather.

Second—Long shaft of tenth primary and wide back feather.

Third—Short shaft of tenth primary and wide back feather.

The indications were that a narrow feather was associated with high egg production and that this type of feather was more common in a bird with short than long feathers. In our strain of White Leghorns, hens with long and narrow and short and wide feathers did not occur frequently. Birds with very long and wide feathers above the average of the flock were also good egg producers. There was a general tendency for hens with long and wide feathers to be the heaviest birds in the flock.

At the end of the first laying year the shank measurements were made of the surviving birds and their mean lengths were as follows:

Group 1 mean shank length 9.79 cm.
Group 2 mean shank length 9.18 cm.
Group 3 mean shank length 10.00 cm.

From this limited information there was some indication that hens with long and wide feathers have shorter shanks than those with short and narrow or wide feathers.

In an inbred or closed flock the variation in feather measurements of the daughters of various sires was not large at approximately 6 and 7 months of age. These results are given in tables 7 and 8.

TABLE VII

Feather Measurements of the Pullet Progeny of 5 Sires

Pen No.	No. of Daughters	Body Weight gm	10th Primary		Centre Tail		Back	
			Length cm.	Width cm.	Length cm.	Width cm.	Length cm.	Width cm.
1	35	1810.6	15.6	1.8	19.9	2.9	4.8	2.4
3	16	1897.9	15.6	1.9	19.7	3.0	5.1	2.2
4	17	1867.8	16.1	1.9	20.6	3.1	5.6	2.6
7	10	1918.2	15.4	1.9	20.3	3.0	4.4	3.3
11	22	1877.2	15.7	1.9	20.0	2.8	6.2	2.7

TABLE VIII

Length of Shaft and Quill of the Pullet Progeny of 5 Sires

Pen No.	10th Primary		Centre Tail		Back	
	Shaft cm.	Quill cm.	Shaft cm.	Quill cm.	Shaft cm.	Quill cm.
1	13.8	1.8	17.6	2.3	4.3	0.6
3	13.7	1.8	17.4	2.3	4.6	0.6
4	14.3	1.8	18.7	2.3	5.1	0.5
7	13.5	1.9	18.0	2.3	3.9	0.5
11	13.9	1.8	18.0	2.0	5.0	0.5

The feathers of these individuals will again be measured at approximately 10 months of age when greater variation in the families may be expected. In addition to the variation in breeding various other factors such as rate of growth, rate of feather growth, sexual maturity, nutrition and hormones are all factors which will influence the results. Further information must also be obtained on the most suitable age at which the feathers must be measured. Reliable results can not be expected if the feathers are immature or if these are worn off at the tips and edges when measured.

Whether the variation in feather length and width can be used in the culling of poultry for egg production must await further experimental results. It is also possible that the dimensions of width and length must be obtained for other feathers or even a group of feathers to give more consistant and reliable results.

THE LEUCOSIS COMPLEX

J. G. CARR
Poultry Research Center, Edinburgh, Scotland

Although we don't know the cause of cancer in most animals, in the fowl we do know that certain forms, but not all, are caused by an infective virus, and these forms include fowl paralysis, leucaemia, and the group of tumours known as sarcomas. For convenience, these are often lumped together as the fowl leucosis complex. Diagnosis is best done by the specialized labs as it is often a specialized job. All lame birds are not cases of fowl paralysis, nor is every damaged nerve damaged because of lymphomatosis.

Losses, due to fowl leucosis have sometimes ranged up to 40 percent. At present, it is no reflection on any breeder to be struck by the disease, as information to prevent it wasn't available. In fact, one sometimes suspects that it specially picks out the better breeders. Yet there are many cases where the disease has been avoided, for example, in Dr. Greenwood's flock, where it has an incidence of less than 1 percent, and this could be cleared up if we wanted. I think the little we have is cherished for my sake.

Now if the disease is due to a virus, we can start by saying that it therefore can't be due to artificial feeding methods, unnatural brooding, battery laying cages, and so on. Also, we should start by agreeing that there is no cure for cancer in a bird. We can cure it by surgery or X-rays, as with human cancer, but this is going to be several times the cost of any bird. And we have no great hope of a pill, because as you will see, the cancer is just another body cell, and anything that kills it will necessarily kill all other cells of the body just as easily, no more and no less. This attitude is an advantage to us, as we can treat the disease as a flock problem, and not worry about individuals.

There is one reason why little hope can be held out for producing a vaccine. Safe vaccination against any one type is difficult and the immunity uncertain. Even if we made available to poultrymen say 316 vaccines against all possibilities that we could find, he has no protection against a 317th. form which might suddenly appear.

If vaccination holds out no hope, we might consider breeding resistant birds. There are several snags to this approach, however. While the disease is rife in a flock, it is easy to select the resistant ones. If the programme is successful, however, as the incidence of the disease decreases, you don't know whether the survivors have been exposed to the disease or not. More important is that since we know that resistance to one virus does not mean resistance to any other, the job is going to be a never-ending one. For as one virus is eliminated by breeding resistant birds, another one can take over. So there is no hope of a cure here. That doesn't mean that it may not be a worth-while approach commercially, for in bad outbreaks even a reduction to a quarter of the worst level may keep one's head above water financially. But the point to be made is that such an approach will not be likely to eliminate the disease. It can only reduce it and hold it in check by a constant and unrelenting struggle. This is, in fact, the result when breeding methods have been tried.

There is one other difficulty about the leucosis complex, one on which I have done a lot of work. If one of these viruses infects an animal that is resistant, the virus will remain in that animal for years, I suspect for all its life. Such a fowl has, therefore, become a carrier of that virus. Similarly, if a chick is infected early in life, the actual disease may not become apparent for many months, but all that time the chick is a possible source of infection. The idea of a carrier of a germ, i.e. an animal that remains healthy but is infected by

a germ and can infect others is often a difficult one to get across, but I expect no difficulty with an audience of poultrymen, who will know the problem of old from the example of B.W.D. or pullorum, where a single carrier can infect a whole flock, or her infected eggs can ruin a complete hatch. At Edinburgh we have found, for example, that a leucaemia carrier can look normal, and her blood can look normal under the microscope, but if such blood is injected into an ordinary chick it will produce death due to leucaemia within a month.

As you will appreciate, this concept of carriers changes the whole picture. If out of 100 chicks, 10 die of leucosis, the other 90 cannot be given a clean bill of health. Perhaps 40 of these carriers and 50 free from the disease. The carriers are going to be a source of danger if kept. In fact, they may be more dangerous than the ones which died, for the dead ones were only a source of infection until they were dead, while the carriers lasted longer. Now with BWD the carrier can be detected by a blood test, but the leucosis carrier cannot be picked out by this method. One reason is the number of viruses that have to be tested for. There are other reasons in addition.

These carriers can be quite interesting to study. For example, the resistance to the virus is often a border-line one, and may break down on slight provocation, and the disease will appear. For example, in some of my experiments, the small injuries inflicted on a hen by a fight with the bird in the next cage have been sufficient to start it up. Even merely moving the birds around will sometimes be enough. This sort of thing may explain why different people often get different death rates due to leucosis with apparently similar birds.

This is end of the gloom.

From what I have been saying, it is fairly obvious that the only line of attack that seems to offer anything is to try and eliminate the viruses. Now one very pleasant thing about the viruses of the leucosis group is that although they are infectious, they are not infectious just by contact of sick and healthy birds like the viruses of fowl pox or Newcastle disease. At Edinburgh, we find we can keep carriers, sick birds and healthy birds in the same brooders and pens, and we never get transfer of the disease. In fact, birds can be fed on lumps of tumour or leucaemic liver without any risk of them getting the disease. Hatching eggs or live birds can be sprayed with the virus without producing the disease. Only deliberate injection of the virus into the tissues will transmit the condition.

But this pleasant state of affairs only applies to conditions of very good management. We once sent a number of our

Edinburgh birds to a place where fowl paralysis was rife and about 30% of them went down with the disease. So the problem of natural transmission remains. Now if the virus must be inoculated, the obvious agent is to suspect one or more of the parasites. It is known, for example, that red mites will transmit the virus. I once had a nice little outbreak of red mites at London, and all my normal birds started growing the tumour I was working with, though the tumour-bearing birds were in separate cages some yards away. We know that in a good case of leucaemia the blood may be so infectious that as little as 1 millionth of a cc, that is 1 thousandth of a mm cubed will transmit the condition. Now any blood-sucking parasite must inject something to stop the blood clotting, otherwise its sucker gets stopped up or even jammed and held in the wound. It is known that other diseases are transmitted this way. For example, the nearest relative of the leucosis group is a rabbit disease called myxomatosis and this is known to be spread by mosquitos. We have not had time to carry out all the experiments we want yet, but it seems likely that the leucosis can similarly be spread by mosquitos, fleas, and midges. Where flying insects are concerned, clearly the disease can be transmitted some distance. Most of these are the kind that breed in water or damp places, while fleas and red mites are purely a result of bad husbandry. It seems that with the new insecticides available, all this risk can be eliminated purely by attention to what is after all, merely the requirements of good management.

Another mode of transmission of the virus is through the egg. This has been contested by some workers, but they did not take into account the existence of carriers, so their evidence is of no particular value. Actually, the carrier, which will live all the time, is a much more serious risk here than the bird which dies of the disease and may leave few or no offspring. We have quite decisive evidence at the Poultry Research Centre that such carriers will transmit the condition through their egg, and the chick may either die of the disease or become another carrier to cause trouble again the next year. Since, if you remember, I said previously that the carrier condition lasts for all the bird's life, it seems at first sight that nothing can be done about it. But I have recently found that the amount of virus produced by infected birds depends greatly upon the age of the bird. For example, at 4 weeks of age a gram of tumour contains several million infective doses, yet a similar tumour in a 12 week-old may only contain a few hundreds, and that is a drop to a ten-thousandth of the pre-

vious amount. There is further evidence that by the age of 1-1½ years the carrier produces practically no infective virus. Therefore I concluded that egg transmitted leucosis is likely to be much more frequent in birds raised from pullet eggs than in birds raised from hen eggs. This was found to be the case with our Edinburgh birds, the risk of leucosis working out at about 25 times greater when pullet eggs were used.

In talking to people about this result, I have found that many practical people already had a suspicion of this result, but because there seemed no scientific reason for it and also because so many queer things seem to happen sometimes with leucosis, they were not absolutely certain of themselves.

This age effect will explain several other things. Firstly, the fact that we are comparatively free from it in Dr. Greenwood's flock. This flock was started over 20 years ago from 6 birds, all over 2 years old, and no fresh blood has been introduced. It also explains why infections in young stock are usually considered to take place in the first 8 weeks or so of life. After that age, a flea-full of blood is unlikely to contain any virus, though at an earlier age a flea-full may contain dozens or hundreds of infective doses. This, I might point out, is also a good argument for trying to keep young chickens of different ages as separate as possible.

Now if I may summarise what I have said:

1. There exists carriers of the leucosis virus
2. Blood-sucking parasites are known to spread the disease from bird to bird, especially in young chicks.
3. The virus is known to be transmitted from carriers through the egg. This risk is much reduced if hatching is not done from pullet eggs.

Of course, I don't for a moment regard this as an argument for always hatching from hen eggs. As far as I am concerned, this is only a technique to be used in certain circumstances, and nothing I have said implies that it should be an unyielding principle. There are plenty of other factors involved.

I hope this talk has been sufficient to show that the scientist is now coming to the stage when he can offer some useful advice about this scourge. As you may realize, we still have plenty to find out, and I don't consider that what I have said is the end of the story. (Presented at Tenth Poultry Stock Improvement Congress.)

UNIFORMITY OF TYPE IN BROILERS

A. J. G. MAW
Poultry Department, Pennsylvania State College, State College, Pa., U.S.A.

The rapid expansion of the broiler industry has led to a search for a better type meat bird. Broiler growers are looking for stock which will grow well, feather fully, have low mortality and use feed efficiently. While much of the improvement in broiler growing has been due to better feeding and control of disease, the popularity of certain breeds and crosses between breeds or strains indicates that breed characteristics also are important.

One of the characteristics desired in a good broiler strain is uniformity of size and type. Certain breeds and strains, which have been used in broiler growing, are weak in this respect. While a group of birds may grow well and otherwise be satisfactory, too much variation in either size or type will bring a lower price.

The striking uniformity found in hybrid corn, and to a limited extent in chickens produced by similar inbreeding methods, suggested the possibility that such methods might be useful in producing broiler chicks. Topcrossing, the mating of inbred males on random-bred females, has been found to result in improved uniformity in hatchability and egg production. This procedure would be adaptable to the breeding of broilers provided sufficient improvement could be obtained to offset the cost of developing and maintaining inbred stocks.

EXPERIMENTAL PROCEDURE

A project was started in 1945 to investigate the possibility of obtaining a greater degree of uniformity in growth and body type by topcrossing. Inbred families of Barred Plymouth Rocks and New Hampshires were developed and each year males from these families, as well as randombred males, were mated to randombred females in either purebred or crossbred mating. The Barred Plymouth Rocks were from a closed flock which had been bred for high egg production and low mortality. The New Hampshires were from a popular commercial strain used for broiler production. After three years of inbreeding, the New Hampshire family developed a low rate of production and fertility was greatly reduced. By the fifth year there were not enough satisfactory males to use in the mating.

TABLE I

Type of Mating

Year	Male Parent		Female Parent
1945	Barred Plymouth Rock	x	New Hampshire
	New Hampshire	x	Barred Plymouth Rock
1946	New Hampshire	x	New Hampshire
	Barred Plymouth Rock	x	Barred Plymouth Rock
	Barred Plymouth Rock	x	New Hampshire
	Barred Plymouth Rock*	x	New Hampshire
	New Hampshire	x	Barred Plymouth Rock
	New Hampshire*	x	Barred Plymouth Rock
1947	Barred Plymouth Rock	x	New Hampshire
	Inbred Barred Plymouth Rock (25)**	x	New Hampshire
	New Hampshire	x	Barred Plymouth Rock
	Inbred New Hampshire (25)**	x	Barred Plymouth Rock
1948	Barred Plymouth Rock	x	New Hampshire
	Inbred Barred Plymouth Rock (12)**	x	New Hampshire
	New Hampshire	x	Barred Plymouth Rock
	Inbred New Hampshire	x	Barred Plymouth Rock
1949	Barred Plymouth Rock	x	New Hampshire
	Inbred Barred Plymouth Rock (25%)	x	New Hampshire
	New Hampshire	x	Barred Plymouth Rock
	Inbred New Hampshire (31)**	x	Barred Plymouth Rock
1950	Barred Plymouth Rock	x	New Hampshire
	Inbred Barred Plymouth Rock (35%)	x	New Hampshire

*From families selected for inbreeding
**Approximate percentage of inbreeding

Table 1 lists the matings which were used. The broilers produced each year from all matings except those marked as inbreds were sired by males from randombred stock. The inbred males used were from families in which the inbreeding was being gradually increased each year. The inbreeding coefficient of the New Hampshire males used in 1949 was 31 per cent while that of the Barred Plymouth Rock males was 25 per cent. In the final test year, the Barred Plymouth Rock males used had an inbreeding coefficient of 35 per cent. In the selection of breeding males, an attempt was made to secure birds representative of the group for that year. This was done because the main objective was to determine the effect the breeding method, rather than the influence of the type of sire, might have on the resulting progeny.

From each mating approximately 225 broilers were grown. They were hatched each year in September and brooded in pens which provided approximately one square foot of floor space per bird. Individual body weights were taken at 2, 8 and

13 weeks of age for the first four years, and at 2, 8 and 12 weeks of age in 1949 and 1950. A sample of birds was drawn from each of the various groups and was dressed and graded for uniformity of type. During the first four years the same ration was used. In the years 1949 and 1950, two changes were made; first, a so-called high energy ration was fed and second, the same group of females was mated to randombred males and later to inbred males.

RESULTS AND DISCUSSION

The weights of the broilers and the variations in weight for all matings are given in table 2. For each year except 1945, comparisons can be made of the weights and variation in weight of the broilers from inbred sires as contrasted with those from randombred sires. In the mating of Barred Plymouth Rock males with New Hampshire females, the male progenies of the inbred males were slightly heavier than those from the randombred males in all years except 1949. The female progenies of the inbred sires were slightly heavier in all years except 1950. In the reciprocal crosses of New Hampshire males with Barred Plymouth Rock females, some of the progenies of the inbred males also were slightly heavier. However, in all cases the differences were small and not statistically significant. In 1949 and 1950, as indicated above, the two classes of males were mated to the same females. The weights of the progenies of the Barred Plymouth Rock males showed no difference while those of the inbred New Hampshire males in 1949 were slightly heavier than those from the randombred males. The weights for these two years were lower than those for the previous years because the length of the growing period was one week shorter.

The percentage variation shown in table 2 is a measure of the variability in weight. It was thought that the use of inbred males might possibly have a beneficial effect in reducing variability. There is no evidence from any of the comparable matings within years that the inbreeding of the male parent had any effect on the variability of the progeny. While there were some differences in certain years, they are not statistically significant. Factors other than the beeding methods evidently determine to a considerable degree the amount of variability in weight.

The amount of feed required per pound of gain during the first four years was high because the ration fed was a standard chick ration. The use of a special broiler ration in 1949 and 1950 gave considerably better feed utilization.

TABLE II

Mean weights, per cent variation and feed consumed

Year	Mating	Males		Females		Pounds feed per Pound of Gain
		Weight	Variation	Weight	Variation	
		Oz.	%	Oz.	%	
1945	B.P.R.xN.H.	64.8	10.7	50.0	9.7	3.5
	N.H.xB.P.R.	59.6	17.5	47.8	10.3	3.4
1946	N.H.	56.2	10.4	44.8	10.6	4.5
	B.P.R.	42.8	19.7	37.9	17.4	4.3
	B.P.R.xN.H.	59.1	12.6	47.4	8.7	4.4
	B.P.R.xN.H.	61.1	9.1	47.8	10.5	3.9
	N.H.xB.P.R.	54.1	14.4	48.4	11.8	4.2
	N.H.xB.P.R.	55.2	13.7	45.6	12.6	4.3
1947	B.P.R.xN.H.	63.1	4.6	50.3	9.6	4.1
Inb.	B.P.R.xN.H.	64.4	9.8	51.5	10.8	3.8
	N.H.xB.P.R.	64.8	10.5	51.4	9.9	4.0
Inb.	N.H.xB.P.R.	64.8	4.9	52.8	8.5	3.8
1948	B.P.R.xN.H.	62.2	21.2	49.3	10.7	3.5
Inb.	B.P.R.xN.H.	65.8	8.6	51.6	5.8	3.3
	N.H.xB.P.R	63.2	11.1	51.9	8.8	3.4
Inb.	N.H.xB.P.R.	67.9	12.6	54.3	8.2	3.6
1949	B.P.R.xN.H.	53.2	8.9	42.0	11.1	3.2
Inb.	B.P.R.xN.H.	51.8	12.1	43.3	7.7	3.1
	N.H.xB.P.R.	53.6	6.6	44.1	6.6	3.3
Inb.	N.H.xB.P.R.	61.4	9.3	48.9	6.9	3.2
1950	B.P.R.xN.H.	57.0	11.4	45.8	9.6	3.2
Inb.	B.P.R.xN.H.	58.2	12.1	45.5	8.8	2.9

The examaination of the dressed carcasses showed no evident differences between groups that could be said to result from the method of breeding. However, within groups it was noted that the progeny of certain single males had a higher percentage of top grade birds than others. The hereditary transmission of body type reported by Maw and Maw (1938) would account for the superiority of the progeny of certain males in this study.

In the commerical breeding of broilers, improvement in type has been obtained by careful selection of the breeding males. The fact that inbreeding of sires as reported here did not reduce variability of progeny would seem to indicate that rigorous mass selection of breeders is a more promising practical method of breeding uniform broilers.

The maintenance of inbred stocks from which males can be obtained for topcrossing adds considerable extra expense to a normal pedigree breeding program. Very definite improvement in weight or increased uniformity would have to be obtained to warrant such a program. Glazener, Blow,

Bostian and Dearstyne (1950) found no consistent reduction in variability of body weight as the maternal degree of relationship increased. Neither did inbreeding bring about a decline in weight or marked improvement in this character. The findings of this study agree with these results and lead to the conclusion that inbreeding is of doubtful value in the breeding of broilers.

SUMMARY

1. Males from inbred lines of Barred Plymouth Rock and New Hampshires were used in crossbred matings with random-bred females to measure the influence of such males on the weight, uniformity of size and feed efficiency of their progenies.

2. There was no significant difference in the weights of broilers from inbred sires as compared to the weights of those from randombred sires.

3. Individual cases of improvement in uniformity of size were found to be due to the type of certain individual sires rather than the breeding method by which they were produced.

4. No differences were observed in respect to feed efficiency.

5. The data indicates that topcrossing with inbred males is of doubtful value in the breeding of broilers.

LITERATURE CITED

Maw, W. A. and A. J. G. Maw. The influence of type of sire on the body size of progeny. *U. S. Egg & Poultry Mag.*, May, 44, 1938.

Glazener, E. W., W. L. Blow, S. H. Bostian and R. S. Dearstyne. Effect of inbreeding on broiler weights and feathering in the fowl. *Poul. Sci.* 30: 108-112, 1950.

POULTRY NUTRITION RESULTS

Agricultural Research Institute, Northern Ireland
Hillsborough, Co. Down

Chick rearing on all-vegetable diets: Two groups of Light Sussex hens have been maintained in specially constructed wire-floored houses to continue the work on the effects of all-vegetable diets on chick growth. An all-vegetable diet has been fed to the hens in order to produce chicks deficient in vitamin B_{12}.

Chicks from these hens are being used for laboratory balance experiments in relation to B_{12} deficiency. They were also

used for two further experiments which have been completed on the value of various natural supplements to the diet of deficient chicks. In one experiment a pure amino-acid was used to supplement the vegetable protein used. In the other, very significant responses were obtained by the addition of natural supplements such as fish meal and condensed fish solubles. A fermentation product containing vitamin B_{12} also proved very effective in stimulating the growth of deficient chicks.

Riboflavin: A group of Light Sussex hens has been maintained on a riboflavin-deficient diet in one of the wire-floored houses, to produce hatching eggs of low riboflavin content for the study of the transfer of the vitamin to the embryo during development.

Antibiotics and chick growth: Penicillin and terramycin have been used in the diet of chicks and it has been shown that the response obtained varies with the type of diet employed. The first experiment during 1951-52 was carried out under floor litter management and the second under battery brooder conditions. In these experiments only a slight growth response was obtained although feed utilization was improved. An experiment in progress at the end of the year suggests that during the initial stages of growth birds fed a diet containing liver meal show a much lower response than those fed dried skim milk as a vitamin supplement. This point will be further investigated.

Thiouracil in cockerel fattening diets: During 1951-52 a further experiment to test the effect of thiouracil addition to fattening cockerels at different body weights was completed. Inclusion of 0.2 per cent. in the diet at 3½ lb. body weight or up to 0.4 per cent. at 6 lb. body weight had no effect on body weight gains.

Sunflower cake meal for laying hens (in collaboration with R. W. Hale) : An experiment was started in September, 1951, to examine the value of sunflower cake meal as a high-protein supplement of vegetable origin in the diet of laying hens. Two hundred Light Sussex pullets were allocated at random to 8 laying houses on the permanent plant, to provide duplicate pens for four treatments. The sunflower cake meal is being tested against fish meal in diets of high and low protein content. To the end of April there were no large differences between treatments as regards rate of egg production.

ALL-MASH RATIONS FOR HENS

F. W. HILL

Cornell University, Ithaca, N. Y., U.S.A.

Current interest in the use of all-mash rations for chickens is high. Much of this interest has come as a result of the increasing attention to labor efficiency which has led to the use of large pens, bulk feed handling, and the mechanical feeder.

The main advantage of an all-mash feeding system is its adaptability to use in an automatic feeding system. An all-mash system also requires less skill on the part of the feeder than does a grain and mash system, since in the latter system some judgment is required in regulating the proportions of grain and mash intake at various seasons. The importance of this feature probably depends at least to some extent on the circumstances and the characteristics of the flock, since feeding systems based on free access to mash and grain for laying hens have been highly successful in many cases.

There are two major disadvantages to the all-mash system. Litter condition is less satisfactory than with a system in which grain is fed in the litter. This is a result of the fact that the hens do not scrach the litter and keep it "worked up" when the all-mash system is used. Furthermore, an all-mash system is more costly than the same amount of feed purchased in mash and grain form. The difference in cost will be at least the necessary charge for grinding and mixing the grain. The fact that the ration does not vary in composition may also be a disadvantage. Insufficient work has been done to show whether all-mash rations which are highly successful for high production strains of White Leghorns, for instance, will be equally satisfactory for breeding flocks of some of the heavy "broiler strains" which are commonly considered to have distinctive nutritional requirements and eating habits.

Ten or more year ago all-mash rations for hens were not successful in the northern part of the United States. With the type of ration used in that period, satisfactory maintenance of body weight and high egg production during the winter months were not found to be possible. Sustained high production depends on high feed intake, the main purpose of which is to meet energy needs, and both production rate and weight maintenance will eventually suffer when nutritive requirements are not fully met. The fact that all-mash rations previously failed during the period when energy requirements

were the highest, that is, during the winter season, suggested that the deficiency in these rations was one of energy. Since that time a great deal more has been learned about the energy values of feedstuffs and the formulation of rations to meet energy needs and other requirements. Accordingly, additional research has recently been conducted to determine if all-mash rations formulated according to this newer knowledge would be more satisfactory in practice. The results of this work show that properly formulated all-mash rations produce satisfactory results.

During the past year an experiment at Cornell compared three all-mash rations formulated to contain three different productive energy levels. The high energy ration contained only corn and wheat as the grain components; a formula

TABLE I

Required nutrient levels for all-mash layer rations.

Nutrient	Amount (% or per lb.)
Protein	15. %
Calcium	2.25 %*
Phosphorus	0.75 %
Available phosphorus	0.45 %
Vitamin A	3300. I.U.
Vitamin D	340. I.C.U.
Riboflavin	0.9 mg.

*Need not be incorporated in the mash; can be supplied by free access to oyster shell or other calcium supplement.

similar to the one used in this experiment is given in Table II as an example of a high energy layer mash. The other two rations contained lower levels of energy, achieved by substituting wheat by-products, pulverized oats, and alfalfa meal for a part of the corn and wheat in the high energy ration. Satisfactory production was maintained by the highest energy level throughout the period of the test, from September, 1951, to August, 1952, with the production level from November through July averaging approximately 70%. The other two rations also produced satisfactory egg production during the early fall and also during the late spring and summer months. There was, however, a marked difference between the rations during the winter months, with the high energy ration consistently superior to the other two in egg production rate.

Efficiency was markedly affected by the energy level of the mash. Although the production rate was higher with the high energy mash, the hens fed this ration consumed approximately five pounds of feed per hundred hens daily less than the hens maintained on the low energy level. The difference in feed

intake and the opposing difference in egg production combined to make the high energy level much more efficient in terms of the feed requirement per dozen eggs produced. It is estimated that on the basis of costs during the past year, the feed cost per dozen eggs was approximately five cents less on the high energy ration than on the low.

These results indicate that the defect in all-mash rations previously used was probably a deficiency in energy value. When a sufficiently high energy level is employed, as illustrated by the ration shown in Table II, satisfactory performance with respect to egg production, weight maintenance, and efficiency can be obtained. Although this study did not directly compare all-mash versus grain-and-mash feeding methods, the results obtained are not greatly different from those which would be expected from a grain-and-mash system under good conditions.

TABLE II.

Example of a high-energy all-mash layer ration.

	lbs.
Yellow corn meal	945
Ground wheat	500
Alfalfa meal (17%)	40
Soybean meal (44%)	250
Fish meal	50
Meat scraps (50%)	50
Distillers' dried solubles	50
Dried whey	50
Dicalcium phosphate	25
Ground limestone	30
Salt	10
Manganese sulfate	0.5
Vitamin A oil (4500/gm)	1
Dry D (1500/gm)	1
	2002.5
Calculated composition:	
Protein, %	16.1
Calcium, %	1.4*
Phosphorus, %	.78
Available phosphorus, %	.56
Vitamin A, I.U./lb.	4400.
Vitamin D, I.C.U./lb.	340.
Riboflavin, mg./lb.	1.3

*Calcium level insufficient to meet requirements for high egg production. Fre-choice feeding of oyster shell or other calcium supplement necessary.

Recent studies at the University of Connecticut have been reported in Bulletin 286 from that experiment station. This work compared two rations, one fairly high and the other quite low in productive energy value and showed both a decreased feed requirement and an increased production rate from the use of the higher energy level. Several other reports during the past ten years, including two from Cornell and

one from the Beltsville Research Center of the U. S. Department of Agriculture, have also concerned comparisons of high and low energy rations, some of them in all-mash form, and have consistently indicated superior results from the use of the higher energy levels.

In the studies recently completed at Cornell, no supplemental feeding was used. According to some field opinions, the use of supplemental pellets is desirable or necessary to get the best results from an all-mash feeding program. The past winter season during which these studies were conducted was not particularly severe in the Ithaca area and it is possible that the sustained high production rate obtained in this work would not have occurred under more severe conditions. Experimental work dealing with the use of pellets in feeding laying hens has shown consistently that they have their main effect on body weight maintenance. Increased feed intake can be expected from the use of pellets, at least during the early stages of their use. It would appear to be wise to employ pellets as a supplemental feed under conditions of severe weather or other circumstances which tend to result in weight losses and lower production rate.

Listed in the tables are the nutrient requirements of hens on the basis of all-mash feeding and a suggested all-mash laying ration formula adapted from one successfully used during the past year at Cornell. (Cornell Feed Service, November, 1952.)

STRAIN DIFFERENCES IN BROAD BREASTED BRONZE TURKEYS

V. S. ASMUNDSON

Division of Poultry Husbandry, University of California, Davis, Calif., U.S.A.

We have always maintained more than one variety of turkeys on the Poultry Plant at Davis and have usually had two or three strains of Bronze. Currently there are two strains of Broad Breasted Bronze. If you think all strains of Broad Breasted Bronze are about the same, some of the differences between these two strains (Nos. 3 and 6) may be interesting.

There was no difference in weight at eight weeks although the average for families of toms varied from 3 to over 4

pounds at this age. At twelve weeks the toms of strain 6 averaged 1/3 of a pound, and at sixteen weeks ¾ of a pound, more than those of strain 3. Strain 6 thus appears to be a little faster growing although the difference is not apparent until the birds are about twelve weeks old.

During February to May inclusive, the hens of strain 6 laid, on the average, about eleven more eggs per hen than those of strain 3. There was one curious feature to the egg production of the hens of these two strains. Some of the hens of each strain were artificially lighted beginning October 15. The hens of strain 6, thus lighted, laid about the same number of eggs after January 31 as the hens of strain 3 but the previously unlighted hens of strain 6 laid eighteen eggs more than the previously unlighted hens of strain 3. That there are strain differences in the response to early lighting is suggested but not proved by these results. We have observed that bringing hens into lay early (in December, for example) tends to reduce egg production a little in April and May. These results, however, merely reemphasize the importance of not bringing hens into production before eggs are wanted for hatching.

Fall (October) lighting apparently increased pausing (both broody and nonbroody pauses) in strain 3. The difference in pausing between the October lighted and unlighted hens of strain 6 was negligible.

Mortality was much higher in strain 3 than strain 6. Fertility and hatchability of fertile eggs was also better in strain 6 matings than those of strain 3. The differences amounted to about 10 per cent of all eggs set.

From the foregoing it is apparent that there are differences between the two strains and these differences are of interest to both growers and hatching egg producers.

We have again had a few Beltsville Small Whites this year (1952). Their reproductive performance, particularly fertility and hatchability, was better than that of the Bronze. On the other hand, the rate of growth was slow compared with the Bronze—1, 2, and 3 pounds less at eight, twelve and sixteen weeks for the White toms than for the Bronze toms. The crossbreds from White X Bronze were intermediate and definitely smaller than the Bronze. Because of this slower growth, the Small Whites do not seem to fully meet the needs of the turkey fryer producer. (California Turkey News).

SULPHAMEZATHINE AGAINST COCCIDIOSIS OF CHICKENS

H. S. OYTUN

Department of Parasitology, Veterinary Faculty, University of Ankara, Turkey

In the course of the treatment of Coccidiosis which had occurred among the chickens of the Animal Breeding Institute of the Agricultural Faculty in Ankara, we diagnosed by microscopical examinations of their oocysts 4 species of coccidia.

These were:

1. Eimeria tenella Railliet and Lucet, 1891
2. Eimeria acervulina Tyzzer, 1929
3. Eimeria mitis Tyzzer, 1929
4. Eimeria praecox Johnson, 1930

The majority of these parasites was diagnosed as Eimeria tenella. The chickens were in bad condition and among them losses had already begun. In microscopical examinations many oocysts of coccidia were observed. The number of the affected chickens were 730. They were grouped in 6 different pens. In order to ascertain the severity of the invasions we made fecal examinations according to the flotation method.

In the microscopic examinations the chickens of which feces revealing 5-10 oocysts in each micropic field were marked with (+) and those of 15-25 oocysts with (++), 30 and more with (+++).

So the I. and II. groups consisting of 175 chickens had shown a severity of (+++)

III. groups consisting of 129 chickens had shown a severity of (++)

IV. groups consisting of 149 chickens had shown a severity of (+)

V. groups consisting of 164 chickens had shown a severity of (+)

VI. groups consisting of 113 chickens had shown a severity of (+)

For the treatment of these cases of coccidiosis we used Sulphamezathine of the Imperial Chemical Industries Ltd. (Turkey). We used a solution of 16% of this drug. 15 grammes of this solution had been added to a litre of water. We gave 0.05 grammes of this drug a day.

After 5 days of treatment dying stopped. The chickens recovered and their appetites became well enough.

To protect the chickens from new invasions we fed them with grains only. Their pens were washed and cleaned. We also took further steps that the chickens might not come into contact with their droppings.

According to our observations we concluded that Sulphamezathine is an efficient drug against Coccidiosis of chickens. (Türk Veteriner Hekimleri Dernegi Dergisi, Year 22, No. 72-73, 280-284, Sept.-Oct. 1952.)

EFFECT OF BUILT UP LITTER ON COCCIDIA AND OTHER PARASITES

W. C. SKOGLUND

Poultry Department, University of New Hampshire
Durham, N. H., U.S.A.

In a recent issue of Poultry Science, F. R. Koutz of the Dept. of Veterinary Parasitology at Ohio State University had an interesting article on this subject. Built up litter or "old litter" as we sometimes call it is a subject of considerable discussion whenever poultrymen get together. The advocates of built up litter claim two main advantages—improved nutrition and sanitation. To elaborate on the latter, Kennard and Chamberlain, also of Ohio State, reported that built up litter is a self-sterilization method in which the action of the litter purifies and destroys the harmful bacteria, protozoa and other disease producing factors.

To prove or disprove this theory experiments were conducted to determine whether the coccidia and other parasites and their ova are destroyed by the action of the litter, whether they are attenuated or whether there is no appreciable destruction of the parasites in the litter.

Baby chicks were started on various types of old litter (based mainly on number of years it had been used), on wire floors, on fresh litter and in a battery brooder. The birds were killed at 12 weeks of age and examined for parasites. All birds on built up litter were heavily infested with parasites such as various species of coccidia, roundworms and capillaria worms. The birds on new litter were free from intestinal nematode parasites although some coccidia were present in a few birds. The weight gains were about the same for all groups. The birds reared in the battery brooder were free of all parasites and averaged heavier weight gains. More work is planned, but this indicates a possible disadvantage of old litter.

CHRONIC RESPIRATORY DISEASE

Dr. JULIUS FABRICANT
New York State Veterinary College
Ithaca, N. Y., U.S.A.

What is chronic respiratory disease? Chronic respiratory disease is a disease of chickens characterized by upper respiratory symptoms (coughing, sneezing, rattling in the windpipe, hoarseness, and sometimes running at the nose). The outward signs of the disease are very similar to those occurring in infectious bronchitis. The striking difference between the two diseases is that, while infectious bronchitis spreads very rapidly in a flock, chronic respiratory disease usually spreads rather slowly. In many cases of chronic respiratory disease only 10-20 per cent of the flock will show symptoms at any one time. Also, while a flock of chickens will practically always recover from bronchitis in two or three weeks, chronic respiratory disease may remain in a flock for very long periods of time. Cases have been observed where the disease has been present over an entire laying season.

If chickens suffering from chronic respiratory disease are killed and examined the following changes may be seen: the trachea (windpipe) contains excessive amounts of mucus, often whitish in appearance; the air sacs may be thickened and covered with a yellow, cheesy material. Sometimes an entire air sac may be filled with this material. Occasionally the nasal passages and sinuses may be reddened or filled with mucus.

These post-mortem changes are not only characteristic of chronic respiratory disease but may also be seen in infectious bronchitis or Newcastle disease or even at times with chronic fowl cholera. If a disease occurs in a poultry flock which is like infectious bronchitis or Newcastle disease in appearance but which is slow-spreading and of long duration, chronic respiratory disease should be suspected.

Is this a new disease of chickens? Apparently not. An essentially similar disease was described as far back as 1936. The disease in the form we know it was described by Dr. Delaplane of Rhode Island in 1943. A similar disease has been seen in the diagnostic laboratory at Ithaca for at least the last 10 years. However, the number of cases of the disease and its importance have increased markedly in the last three years. It has become a special problem in the broiler industry where the disease is often known as "air sac colds" or "air sac infection."

What harm does the disease do? It is difficult to answer this question accurately at this time because the disease often does not occur alone but is associated with Newcastle disease, infectious bronchitis, chronic fowl cholera, and other bacterial infections. It is hard to say which of the disease agents present are doing the damage.

The disease or mixture of diseases often causes mortality in broilers, and severe economic loss due to poor weight gains and to condemnation of carcasses in the dressing plants because of air sac infection. In layers, the extent of the drop in egg production is variable. In some cases it is negligible, and in others it may be as severe as 30-40 per cent. Many of the cases in which a severe drop in egg production occurred were those in which chronic fowl cholera was also present. Some deaths have been reported in laying flocks also.

What is the cause of chronic respiratory disease? The best information we have now would indicate that the disease is caused by an organism of the pleuro-pneumonia group. These organisms are intermediate in size between small bacteria and large viruses.

What is the relationship between chronic respiratory disease in chickens and infectious sinusitis in turkeys? The organisms which cause these two diseases are so similar that it is impossible to tell one from the other. Organisms from either disease can cause sinusitis in turkeys and respiratory disease in chickens in the laboratory. Their relationship under field conditions, however, has not been established.

What part do Newcastle disease and infectious bronchitis play in the disease? Chronic respiratory disease has often been observed to occur following a natural case of Newcastle disease or infectious bronchitis following immunization procedures against these diseases. When these cases were studied it was discovered that the vaccines used against these diseases did not contain the agent of chronic respiratory disease. In fact, in some cases it was found that only one of several lots of birds on the same farm inoculated with Newcastle vaccine or bronchitis virus would come down with chronic respiratory disease while the others remained free of the disease. In addition it was demonstrated that birds which were immune to both Newcastle disease and infectious bronchitis could still be infected with chronic respiratory disease. This clearly indicated that chronic respiratory disease was a separate and distinct disease.

What, then, is the relationship between immunization and the subsequent attack with chronic respiratory disease?

Apparently, it is this. Chronic respiratory disease may occur in a flock as such a mild disease that it is not noticed. However, if a second disease is brought into the flock it increases the severity of the chronic respiratory disease and brings it into a more active form and remains so after the Newcastle or infectious bronchitis subsides and disappears.

How is the disease spread? Very little is known about the means of spread of chronic respiratory disease. Apparently it spreads in much the same manner as other respiratory diseases. However, work in progress suggests the possibility that this disease may also be transmitted through the egg.

How can the disease be controlled? As yet too little is known about the disease to formulate successful control measures. There is no work at present to indicate that any vaccine would be effective. A great deal of field work without adequate controls has been done with the use of antibiotics (aureomycin, terramycin, chloromycetin, etc.) in the control of this disease. The results of this work are not consistent but it is apparent that while these drugs may sometimes be able to decrease the severity of symptoms enough to produce marketable birds, they are not able to eliminate the disease entirely from infected flocks. (Yearbook 1952-53, Poultry Improvement Board of New York, Ithaca, N. Y.)

DR. MARQUEZ, PHILIPPINES, VISITS U.S.A.

For six months, from the latter part of August 1952 to February 1953, Dr. Lameno S. Marquez, Poultryman of the Bureau of Animal Industry, Manila, Philippine Islands, is visiting universities, experiment stations, and agricultural research centers in the United States. Dr. Marquez has charge of the poultry work carried on by the Bureau and while in the United States will make a special study of poultry research work carried on in this country. He is particularly interested in poultry breeding methods and wants to gain as much information as possible concerning modern poultry husbandry practices.—Morley A. Jull.

IRAN AND THAILAND REPRESENTATIVES STUDYING U. S. POULTRY CONDITIONS AND METHODS

With a view toward developing the poultry industry of their respective countries, the Governments of Iran and Thailand have sent representatives to the United States for several months to study conditions under which market eggs and broilers are produced and methods by which the Federal Government and State Colleges of Agriculture serve to improve conditions in the poultry industry.

Mr. S. Mohammad Madany, Teachers Training College, Tehran University, has already spent considerable time at the U. S. Agricultural Research Center at Beltsville, Md., and with staff members of the poultry departments of several state colleges of agriculture. He has made a special study of poultry husbandry practices and is particularly interested in methods of breeding to increase egg production.

Mr. Prasob Buranamanas, a graduate of the College of Chulalonghorn University and Chief of the Small Animal Section of the Department of Agriculture, Bangkok, Thailand, is spending his time studying teaching, research, and extension methods on behalf of the poultry industry in the United States. He is particularly interested in duck and chicken egg production and marketing methods.—Morley A. Jull.

PROF. TORRES OF BRAZIL VISITS U.S.A.

Prof. A. Di Daravicini Torres, Escola Sup. Agr. "Luis de Quetroz," Universidade de Sao Paulo, visited several poultry departments in the United States in October with a view toward learning something of the extension and research work being carried on. Sao Paulo is one of the most important poultry producing states in Brazil.—Morley A. Jull.

LINDANE FOR POULTRY PESTS

In the last number of the World's Poultry Science Journal there appeared a note concerning the use of lindane for lice. Attention is called to the fact that the New Jersey Agricultural Experiment Station, New Brunswick, New Jersey, has published Leaflet 52 entitled "Lindane for Poultry Pests."

WORLD'S POULTRY SCIENCE LIBRARY

Reviewer: W. C. Thompson
Department of Poultry Husbandry,
Rutgers University, New Brunswick, N. J., U.S.A.

THE POULTRY PROFIT GUIDE—1952—John P. Weeks—First Edition—Vulcan Service Co., Inc., Birmingham, Alabama, U.S.A.—395 pages—$3.50.

This reviewer has been delighted to find several good new books on poultry subjects coming from the presses during the summer of 1952. Mr. Weeks, who is Extension Service poultryman at the Alabama Polytechnic Institute, Auburn, Alabama, has kept his eyes open as his job has given him opportunity to visit countless poultrymen in that area of the United States, the south, where he has worked. He writes not only as a keen student of the factors which constitute successful poultry farm production and management, but as an absorbent traveler who believes in learning by seeing what is happening about him. This book, printed on splendid art paper, is most handsomely illustrated. The pictures have been chosen for the definite purpose of clarifying the text. Many of the pictures are in full color which adds tremendously to the appeal of the book as a whole. The author begins by presenting facts and figures concerning economic and business aspects of the American poultry industry, but he succeeds in presenting this material in an attractive and useful form.

His book, while presented as a general textbook on modern poultry husbandry, does, it seems to this reviewer, become at once another new book in which the primary emphasis is upon management factors. The author has given due credit to the editor of the book, Mr. Robert Chestnut and to his two contributing authors Mr. G. T. Kline and Mr. Joe W. Sicer.

Nearly 400 pages of text material are included in this volume, divided into 17 chapters. The latter chapters of the book deal primarily with the turkey industry, the particular contribution of Mr. Kline. The reviewer feels that Chapter 17 "Rabbits and Miscellaneous Poultry (Pigeons, Ducks, Geese and Guineas)" undertook to discuss a rather vast number of subjects with the result that the reader leaves that chapter wishing that the discussions had been a little more complete. The chapter does, however, add materially to the value of textbook as a whole. To whet an appetite for something good is usually a desirable objective. The style in which this book has been written is easily followed and enhances quick and interesting reading. One does not have to hunt around for the points one wishes to get out of the discussions promised under each chapter heading. The reading matter is well organized. Each chapter is concluded by giving a list of questions for class discussion and a list of activities for study groups to undertake as well as a list of references to material which will enlarge upon the subject matter of the preceding chapter.

Teachers will find these features particularly helpful. They have been put together with very real care and very apparently by authors who were well versed in the art of teaching.

LAS GALLINAS UTRERANAS—1950—Joaquin Del Castillo—First Edition—In Spanish—Published by Tipografia Moderna, Avellanas, 9. Valencia, Spain—140 pages.

Through the courtesy of Mr. J. W. Kinghorne of the U.S.D.A. this reviewer's attention has been called to the availability during the past year of this poultry book written in the Spanish language and entitled "Las Gallinas Utreranas." Through a translation of the text one learns

that this book is devoted primarily to a discussion of a new commercial breed of chickens in Spain, the "Utreranas." The originators of this new breed of fowls have proceeded upon a sound, scientific basis. They have attempted to study and then to apply the most modern finding in Genetics to the problem which they set for themselves. It apparently is a good example of a breed of chickens "made to order," that is developed with certain objectives in mind.

Too many of our present day breeds of fowls have been rather haphazardly produced and with no particular reference to the need of the industry for something new or the particular service which might be rendered by the new form. It is suggested that poultrymen and poultry scientists who use the Spanish language with facility will be particularly interested in this offering by Senor Joaquin Del Castillo.

GENETICS—THE SCIENCE OF HEREDITY—1950—John Pfeiffer—Golden Jubilee of Genetic edition—Published by the Genetics Society of America—One of the Public Affairs Committee, Inc. Pamphlets—32 pages—20 cents.

This brief booklet on Genetics was a part of the celebration of the 50th year of Genetics by the Genetics Society of America. The discussion of the science of heredity, while extremely brief, has managed to catch the high points in the development of Genetics as a science during the past half century. It mentions practical cases where "breeding to order" has served farmers and people generally in very large and significant ways. To mention but two instances is to include the production of hybrid corn and again the production of hybrid chickens. It is a well publicized effort to attract the attention of more people to the mighty role which Genetics is playing in the development of all phases of life in this 20th century.

POULTRY MANAGEMENT—1952—G. F. Heuser, G. O. Hall, J. H. Bruckner, all of Cornell University, Ithaca, New York, U.S.A.—First Edition—J. B. Lippincott Co., Philadelphia, Pa.

These authors, all University Professors of many years of experience, have presented the subject of poultry management in a most easily read form and for two particular groups of readers.

First, they have, through experience, learned what poultry students in the vocational courses in Poultry Husbandry in our high schools and colleges want to know about the problems of poultry flock management. They have presented answers for such vocationally-minded students. Secondly, they have realized that several millions of men and women throughout the world are interested in poultry and egg production from a most utilitarian point of view. Their chief interest in the modern poultry industry is its opportunity of earning a livelihood for them. They see the enterprise primarily as a business proposition. They seek the 'know-how.' To write a textbook which would definitely interest these two groups of potential readers without making it appear in anyway absurdly simple and without injuring in any way the full dignity of modern poultry science is an art and accomplishment. These authors have presented the many facets of modern commercial poultry farming in so clear and logical a fashion as to win enthusiasm from vocational poultrymen everywhere. They have a text of approximately 565 pages, divided into 15 well-chosen chapters. The publishers merit a word of particular commendation for their fine job of printing and book construction presented in this textbook.

Particular emphasis has been placed upon the farm jobs, such as 'culling the farm flock,' and 'housing the flock,' and 'hatching the chicks,' etc., which all contribute to successful production. Within each chapter ways and means of accomplishing efficient results at lowest possible costs are indicated. That is a most helpful feature of the book. The margins of the book are unusually narrow which means that the book is crowded full of facts and comments. It will serve a purpose where economy and efficiency of farm management as applied to poultry and eggs is demanded. It deserves a respected place on the poultry scientists book shelves as well as in the library of the practical poultryman. After all the end objective of all of the research and teaching which is being

done in these days is to establish a method of poultry and egg production which is scientifically sound, economically feasible and reasonably endurable for many years which lie ahead.

BUSINESS ASPECTS OF COMMERCIAL POULTRY FARMING—1952—L. B. Darrah—First Edition—The Ronald Press Company, New York City, N. Y., U.S.A.—204 pages.

The publishers made available to this reviewer advanced press sheets for this new book by Dr. Darrah of Cornell University in order that this review might be prepared in time for inclusion in this issue of the Journal. It was announced that publication date for Dr. Darrah's book on "Business Aspects of Commercial Poultry Farming" would be about October 15, 1952. It is indeed a very new book in the field of Poultry Science. It is particularly welcomed by the poultry industry because there have been all too few studies published concerning the business management phases of modern poultry science. One needs to be well familiar with the scientific backgrounds and principles which underlie successful poultry and egg production and distribution, but in order that the poultry industry may continue to furnish the extremely useful and necessary food products which it does do, a firm grasp of the economic phases of the industry must be equally born in mind. The title of this new book has been expertly chosen for it well defines the contents of the volume. Approximately 204 pages of material have been divided into 12 strong chapters for this presentation.

This reviewer feels that poultry men and poultry scientists in various countries throughout the world will find particular interest in the first chapter which deals with 'The Growth of the Poultry and Egg Industry,' in a most useful and lucid manner. The second chapter on 'Poultry Farming as a Business' is an excellent statement of the fundamental proposition to which the book as a whole is dedicated. The student of the modern poultry industry realizes anew each year that the success of the world's poultry production enterprises will be largely measured by the demand for the products of the industry which is made by the population as a whole. The student of present-day poultry management will find Dr. Darrah's third chapter on 'The Demand for Poultry and Eggs' particlularly stimulating and indicative of a firm place for the industry and its products in the future lives of all peoples everywhere. One is tempted to go on through the titles of the other nine chapters but time and space do not permit. It is perhaps sufficient to say that the chapters deal with such items as prices, markets, merchandising, costs, labor efficiency, etc., in well organized order: finally, showing how important is the management factor in spelling out the success of commercial poultry and egg production in these days.

Teachers of Poultry Husbandry in schools and colleges will welcome this volume because it fills a gap which has existed for many years in the library of poultry books. The book is beautifully printed on fine art paper so that its many splendid illustrations stand out remarkably clearly. It is a nice book to own; it is a handsome book to have in one's library. It is the result of many years of study devoted to the statistics of the poultry industry. The author has made his statistics interesting and absorbing: too often statistics are dull and tiresome. He has shown clearly a purpose in the presentation of data and facts concerning the commercial poultry and egg industry of the United States of America. He has indicated the way along which the American poultry industry has come through the years. He indicates rather definitely the place which it can occupy in the future. He establishes a pattern which many of those interested in the building of a commercial poultry industry elsewhere may wish to follow. His stress upon the quality of poultry and egg products which should be produced is admirable; his emphasis upon the efficiency of the human element involved is well taken. The book reads smoothly and easily from cover to cover. It will find eager readers amongst students, scientists and practical poultry raisers.

REVIEW OF POULTRY PUBLICATIONS

Compiled by J. W. Kinghorne,

1365 Iris St., N.W.

Washington 12, D.C., U.S.A.

GENETICS

HUTT, F. B. (Dept. of Poultry Husbandry, Cornell Univ. Agric. Expt. Sta., Ithaca, New York)

LETHAL ACTION OF THE GENE FOR EXTENSION OF BLACK PIGMENT IN THE FOWL. *Genetics 36:* 213-234. 1951.—Among chicks from the cross, Barred Plymouth Rock females x Rhode Island Red Males, about 1% or more of the females show bare backs at hatching. These chicks lack much of the down in the posterior-spinal feather tract, and what remains is abnormally short. There are all gradations between extreme variants and the normal. Males are affected so rarely that none with bare back may be seen among many thousands. Genetic analysis showed that the defect is found only in chicks with extended black (E), and never in their siblings with Columbian restriction (ee). This association results from a pleiotropic effect on E, which shortens the plumules that comprise the down. The shortening is not localized on the back, although it is most conspicuous there. Measurements of feathers showed that sex-linked barring (B) prevents E from shortening the down excessively and thus protects the male offspring of this cross. The silver and gold alleles (S and s) do not affect length of down. Reduction of down induced by E is lethal to about 3.5-3.7% of the black, non-barred females from this cross. This was shown not only by significant deficiencies of females in over 33 million chicks hatched, but also by a corresponding excess of females with bare backs found among an adequate sample of eggs that failed to hatch. The deaths occur chiefly during the last 2 days of incubation. Since the female chicks are much more valuable than the males, the loss is doubly serious. It was found that this lethal effect of E cost one hatchery alone over $178,000 in a decade. Bare-backed females that did hatch were fully equal to their normal sisters in viability, age at first egg, body weight, and egg production. Evidence was found by diallel crosses that the chicks with extremely bare backs and the lethal action of E may be avoided by using sires that have rapid feathering (kk) rather than slow feathering (Kk or KK).—*Auth. summ.* (Biological Abstracts)

LORENZ, F. W., and J. D. CARSON. (U. California, Davis.)

ARTIFICIAL BREEDING OF TURKEYS. *Calif. Agric. 5(12):* 4, 11, 1951.—Artificial insemination of turkeys requires exacting procedures but offers specific advantages over natural mating: need for saddles, is eliminated, fewer males are needed, and fertility is increased.—*G. W. Bohn.* (Biological Abstracts)

MARCELLIN, M. R.

LA POULE DE MARANS. [THE MARANS BREED OF DOMESTIC FOWL.] *Bull. Tech. Inform. Ingénieurs Serv. Agric. 57:* 209-222. Illus. 1951.—This red egg laying hen is bred in the Vendée, Charente Maritime and Deux Sèvres Departs., and includes at least 3 vars.: the

silvery coucou, the coppery black, and the white, of which genetic formulas and standards of perfection are given.—*M. Claude.* (Biological Abstracts)

POIRIER, R. P.
CE QUE LA GENETIQUE DOIT A L'AVICULTURE. *Rev. Oka: Agron., Med., Vet. 23(5):* 163-196. 1949.—Review of the known hereditary characters—normal and pathological—of American breeds of poultry.—*L. M. Lalonde.* (Biological Abstracts)

PHYSIOLOGY

ANDREWS, F. N. (Purdue U., Lafayette, Ind.)
THE PRACTICAL IMPORTANCE OF HORMONES IN ANIMAL FEEDING. *Amer. Egg and Poultry Rev. 12(7):* 30-31. 1951.—A brief review of the effects of the use of female sex hormones on growth of chickens and beef cattle. The effect of feeding thiouracil and thyroproteins is also described. The human health aspects are mentioned.—*H. G. Lindquist.* (Biological Abstracts)

ASPEREN, R. van.
DE STOFWISSELING VAN HET 4-METHYL-2-THIOURACIL NA ORALE TOEDIENING BIJ JONGE HANEN. [THE METABOLISM OF ORALLY ADMINISTERED 4-METHYL-2-THIOURACIL (MTU) IN COCKERELS.] *Tijdschr. Diergeneesk. 76.* 133-155. 1951.—Daily doses of 40, 50, 80, 100 and 120 mg. of mtu were used. About 50% of the mtu may be recovered from the excrement within 24 hrs. after the admn. The rate of excretion is max. about 2.6 hrs. after the admn. Most of the excretion takes place within 11 hrs.; excretion is almost complete after 24 hrs. In blood plasma and muscle tissue the max. concns. are reached in 2-5 hrs.; after that a rapid decline takes place and after 20-24 hrs. no or very little mtu may be found. Mtu concns. in thyroid tissue are markedly higher than those found by other investigators. Mtu is equally distributed among the muscle tissues of the body.—*K. Büchli.* (Biological Abstracts)

BASTIAN, J. W., and M. X. ZARROW. (Purdue U., W. Lafayette, Ind.)
FAILURE OF NEMBUTAL TO BLOCK OVULATION IN THE HEN. *Proc. Soc. Exptl. Biol. and Med. 79:* 249-252. 1952.—Nembutal anesthesia was induced for periods of 2 and 12 hrs. in laying hens in an attempt to inhibit the normal release of luteinizing hormone (L.H.) Ovulation occurred in more than 80% of the birds despite the length of anesthesia, indicating a release of LH during the time of narcosis. In a 2d expt. hens were anesthetized with nembutal for 1.5 to 6 hrs. and an attempt made to induce ovulation by progesterone. Ovulation was obtained in 100% of the birds anesthetized for 1.5 hours and in 80% of the birds anesthetized for 6 hours. This compares favorably with the 83% ovulation noted in the control hens treated only with progesterone. Nembutal-induced anesthesia does not interfere with the release of LH in the hen.—*M. X. Zarrow.* (Biological Abstracts)

BURLINGTON, H., and V. F. LINDEMAN. (Syracuse U., Syracuse, N. Y.)
ACTION OF DDT ON THE BLOOD OF THE CHICKEN. *Fed. Proc. 11(1):* 20-21. 1952.—*An abstract.* (Biological Abstracts)

BUTT, E. M., H. E. PEARSON, and D. G. SIMONSEN. (U. So. California, Los Angeles.)
PRODUCTION OF MENINGOCELES AND CRANIOSCHISIS IN CHICK EMBRYOS WITH LEAD NITRATE. *Proc. Soc. Exptl. Biol. and Med. 79:* 247-249. 1952.—Injn. of Pb into the albumen of fertile eggs may result in the production of meningoceles in chick embryos. Cu and

Hg ions were noted to be as toxic as similar quantities of the Pb ion but meningoceles were not seen in embryos surviving 13 days incubation. Na salts of the anions used in the metal expts. failed to produce meningoceles. (Biological Abstracts)

COMMON, R. H., D. G. CHAPMAN, and W. A. MAW.
THE EFFECT OF GONADAL HORMONES ON THE NUCLEIC ACID CONTENT OF LIVER AND SERUM IN THE IMMATURE PULLET, AND THE DIFFERENCE BETWEEN THE NUCLEIC ACID CONTENT OF THE LIVERS OF SEXUALLY MATURE PULLETS AND COCKERELS. *Canadian Jour. Zool. 29:* 265-275. 1951.—Treatment of sexually immature pullets with testosterone propionate so as to evoke changes in combs and wattles similar to normal puberal changes did not affect liver wt. or liver content of nucleic acids. Estradiol benzoate, or estradiol benzoate plus testosterone propionate, increased liver weight and total liver pentose nucleic acid, and slightly increased liver desoxypentose nucleic acid. Chemical evidence is adduced in support of the view that the increase of liver crude protein caused by estrogen is a consequence of cellular hypertrophy accompanied by a slight degree of hyperplasia. The ratio RNAP:DNAP was relatively high in the liver of the young chicken, but declined somewhat during the first 12 wks. With the onset of reproductive activity, the ratio RNAP:DNAP increased in the livers of the females but did not show a similar tendency in the males. The results suggest that there is a sexual differentiation in the nucleic acid content of the livers of the mature fowl, and that this is reasonably attributable to endogenous estrogen activity. Data are presented in confirmation of the reported effect of estrogen in increasing serum or plasma nucleic acid in the fowl, androgen being without any such effect.—*Auth. abst.* (Biological Abstracts)

FORBES, J. C., and O. PETTERSON. (Med. Coll. Virginia, Richmond.)
PLASMA CHOLESTEROL OF ROOSTERS UNDER VARIOUS CONDITIONS. *Proc. Soc. Exptl. Biol. and Med. 78:* 883-885. 1951.—Subcut. admn. of diethylstilbestrol to cockerels caused a marked increase in the concn. of the "readily extractable" cholesterol of the plasma as well as in total cholesterol and neutral fat. Cholesterol feeding exerted a similar effect, but at moderately elevated plasma cholesterol levels the concn. of the "readily extractable" fraction was not as great as when the total cholesterol was raised by admn. of estrogens. However, when total cholesterol was high, about 700 mg.%, practically all of it was present in the "readily extractable" form. Roosters receiving a high fat diet for several weeks usually showed a definite increase in the "readily extractable" fraction without a consistent increase in total cholesterol. When the diet contained 10% soybean lecithin the concns. of both the total cholesterol and of the "readily extractable" fraction dropped below those found in animals on the basal diet.—*Auth. summ.* (Biological Abstracts)

HIEBEL, G. and CH. KAYSER. (Fac. Med., Strasbourg.)
LE RYTHME NYCTHEMERAL DE L'ACTIVITE ET DE LA CALORIFICATION CHEZ L'EMBRYON DE POULET ET LE JEUNE POULET (Light Sussex). [NYCTOHEMERAL RHYTHM OF ACTIVITY AND HEAT PRODUCTION OF THE CHICK EMBRYO AND YOUNG CHICK.] *Compt. Rend. Soc. Biol. 243(11/12):* 864-866. 1949.—Registration of the movements of the entire egg (suspended in a small metallic basket connected to a Marey tambour) in an incubator with constant light, does not disclose an ephemeral rhythm of activity. The newborn chick has a continuous activity for 24 hrs. without any trace of rhythm if it is maintained in constant light. By means of calorimetry and recording of movement it can be shown that rhythm of movement can be impressed upon young chicks by alternate light (6 hrs.) and darkness (6 hrs.), but up to the age of 2 mos. it is not possible to demonstrate the slightest trace of "memory" of the rhythms artificially achieved during 12 and 16 consecutive days.—*J. M. Harl.* (Biological Abstracts)

LIBBY, DAVID, and JOSEPH MEITES. (Michigan State Coll., E. Lansing.) EFFECTS OF VITAMIN B_{12} AND PENICILLIN ON THIOURACIL ACTION IN CHICKS. *Proc. Soc. Exptl. Biol. and Med. 79:* 370-372. 1952.—White Leghorn male and Rhode Island Red chicks of both sexes were fed a vit. B_{12}-deficient ration which was supplemented with 0.1% thiouracil and/or 0.5 to 4.0 μg.% vit. B_{12} or 2 mg. procaine penicillin G per lb. of food. After a preliminary depletion period of 1 and 2 wks., respectively, on the vit. B_{12}-deficient diet, the chicks were fed the above supplements for an additional 4 or 3 week period. Thiouracil markedly reduced body wt. gains and food intake in both breeds of chicks, and increased the grams of food required for each g. of gain in body wt. Vit. B_{12} and penicillin partially or completely counteracted this growth depression and increased appetite. The larger doses of vit. B_{12} were more effective in these respects than the smaller doses. The large increase in thyroid wt. and severe inhibition of comb growth induced by thiouracil were not influenced by the vitamin or antibiotic. In general, these results corroborate previous data on the effects of vit. B_{12} and antibiotics on rats fed thiouracil or following parathyroidectomy.—*Joseph Meites.* (Biological Abstracts)

MAHADEVAN, T. D., and S. BOSE. (Indian Vet. Res Inst., Izatnagar.) THE DETERMINATION OF THE PERCENTAGE OF EDIBLE FLESH IN THE RHODE ISLAND RED, WHITE LEGHORN AND DESI (INDIGEOUS) COCKERELS AT DIFFERENT STAGES OF GROWTH. *Indian Jour. Vet. Sci. and Animal Husbandry 21:* 39-41. 1951.—Of the 3 breeds studied cockerels of indigenous breed were the most efficient as market poultry as judged by flesh to bone ratio and conformation of dressed carcass at all stages of growth from 8 to 24 wks. White Leghorn cockerels were the least efficient. The avg. food consumed was same in desi and White Leghorn, while that of Rhode Island Red cockerels was higher.—*N. N. Dastur.* (Biological Abstracts)

SKALLER, F., and G. W. GRIGG. THE EFFECT OF ORALLY ADMINISTERED SYNTHETIC OESTROGEN (HEXOESTROL) ON THE MALE FOWL. *Australian Jour. Agric. Res. 1:* 496-516. Illus. 1952.—In 3 expts., involving a total of 141 male fowls the effect of orally administered hexestrol on cockerels of different ages and breeds was observed, and the results were compared with those from untreated birds and capons. The results obtained support the hypothesis of a 2-fold action of estrogen, viz., its action as a stimulator during an initial period and a depressor of the anterior pituitary gland after a certain threshold level has been reached. Sensitivity to estrogen increased with age, varied according to different breeds, (e.g., White Leghorns gave a smaller response than Australorps), and varied according to tissue; e.g., it was higher for the testes than for the comb and epidermis. It was observed that the size of the testes in 3-month-old cockerels varied greatly and that the amt. of abdominal fat was not closely and reliably correlated with the total body fat. Estrogen treatment improved the appearance of the carcass. Deposition of abdominal fat was increased only for Australorps and mature birds. Capons were superior in body-fat production to the estrogen-treated birds. Fat from birds treated with hexestrol (up to 25 mg. daily for 3 wks.) did not produce estrogenic effects when injd. into mice. The observations did not support the hypothesis of Wheeler and Hoffman (1948) that estrogen treatment increases the occurrence of prolapse and "pick-out."—*Auth. summ.* (Biological Abstracts)

NUTRITION

ALMQUIST, H. J. (The Grange Co., Sacramento, Calif.) PROTEIN REQUIREMENTS OF GROWING TURKEYS. *Feedstuffs 24(8):* 44-50. 1952.—In general, the first 4 lbs. of body wt. are produced most efficiently with a starting ration containing about 28% pro-

tein. There is some difference in efficiency of males and females, the females requiring somewhat more protein. After the first 4 lbs. the next 6 lbs. of body wt. seem to have been put on at a relatively constant rate, regardless of level of protein, within the limits used, and a 24% protein level appeared adequate. Birds gaining the first 4 lbs. most rapidly carried this advantage to marketing time. A shift from the 28% protein down to 20% at 6 wks. of age resulted in retardation of rate of growth. Hens consume higher proportions of grain at any given age when the grain is self-fed. Broad-breasted bronze and Beltsvilles responded similarly to protein levels.—*H. L. Wilcke* (Biological Abstracts)

ALMQUIST, H. J., and J. B. MERRITT. (The Grange Co., Modesto, Calif.) EFFECT OF SOYBEAN ANTITRYPSIN ON GROWTH OF THE CHICK. *Arch. Biochem. and Biophys. 35:* 352-354. 1952.—Chicks were fed complete diets containing protein exclusively from soybean meal, either cooked or raw or in combinations, at a total of 20% protein. As little as 5% of raw protein was accompanied by nearly max. growth retardation due to the tryptic inhibitor in raw soybean meal. The growth inhibition was overcome by adding trypsin to the diet. Such a result may be explained by assuming that one component of the proteolytic enzyme system in the chick such as trypsin was almost completely inactivated by a substance, such as the antitrypsin, at the 5% raw protein stage, leaving the remainder of the enzyme system to function, but at a reduced efficiency. (Biological Abstracts)

ANDERSON, J. O., and G. R. COMBS. (U. Maryland, College Park.) EFFECT OF SINGLE AMINO ACID EXCESSES ON GLUCOSE METABOLISM AND CHICK GROWTH, AS INFLUENCED BY THE DIETARY AMINO ACID BALANCE. *Jour. Nutrition 46:* 161-170. 1952.—Expts. were conducted to determine if the growth depression in chicks caused by feeding high levels of DL-lysine HCl, L-tyrosine, or DL-methionine could be overcome. The depression caused by the addition of lysine was proportionately less when zein, corn, or additional gelatin was included in the diet, and that caused by excess tyrosine was also less when additional gelatin was added. The added proteins appear to provide a more favorable amino acid balance. Despite this, the growth depression caused by feeding excess methionine was not influenced by adding arginin or gelatin. In this case, the restricted feed intake was probably largely responsible. Chicks fed high and normal levels of various amino acids were subjected to glucose tolerance tests. In chicks fed diets high in DL-methionine, DL-lysine HCl, or DL-phenylalanine, the blood glucose level following sugar ingestion did not return to normal as rapidly as when the diets were normal or high in L-arginine HCl, L-leucine, or glycine.—*Auth.* (Courtesy Wistar Bibl. Serv.)

ASENJO, CONRADO F. (U. Puerto Rico, San Juan.) RIBOFLAVIN IN EGGS FROM HENS OF DIFFERENT BREEDS RAISED IN PUERTO RICO. *Jour. Agric. Univ. Puerto Rico 34:* 322-326. [1950] 1952.—Eggs from the La Plata Animal Production Sub-Station, between Cayey and Aibonito, had a riboflavin content of 3.89 μg. from native hens, 4.7 μg. from White Leghorns and 5.18 μg. from New Hampshires, all having been fed a mash containing an avg. of 2.63 μg. of riboflavin per g.—*G. N. Wolcott.* (Biological Abstracts)

BENTLEY, O. G. (Ohio Agr. Expt. Sta., Wooster.) SOME FACTORS THAT INFLUENCE THE RESPONSE TO VITAMIN B_{12} AND ANTIBIOTICS. *Feedstuffs 24(3):* 46-49. 1952.—Vit. B_{12} produced a growth response when added to a corn-soybean oil-meal type diet at the 22.0% protein level, but not at the 14.3% level. Some of the symptoms of choline and methionine deficiencies in rats and chicks can be corrected by feeding vit. B_{12}, and the requirements for vit. B_{12} can be reduced by supplementing with methionine and choline. Vit. B_{12} and pantothenic acid have a mutual sparing action. Symptoms of B_{12} deficiency exhibited by mice on low-fat diets may be partially corrected by feeding a higher level of fat. Aureomycin will meet completely the B_{12} requirements in the rat, but not in the fowl. In chicks 14-16%

protein rations supplemented with antibiotics perform as well as 17-19% rations without antibiotics. Antibiotics produce greater responses when the basal ration contains fish meal. Therefore, there are probably unidentified growth factors involved. The level of pyridoxine affected the magnitude of the response to aureomycin in rats. Aureomycin and streptomycin produced the best results with pantothenic-acid- and riboflavin-deficient diets, and penicillin with thiamine deficiencies. Terramycin was not active with these deficiencies. Responses to antibiotics appear to be improved by the addition of certain products such as distillers' solubles, fish solubles, butyl fermentation solubles, grass juice concentrate, and dried whey.—*H. L. Wilcke.* (Biological Abstracts)

BERG, LAWRENCE R. (State Coll. Washington, Pullman.)
UNIDENTIFIED FACTORS IN FISH BY-PRODUCTS REQUIRED FOR QUICK GROWTH. *Feedstuffs 24(22):* 12, 44. 1952.—Fish products carry an unidentified factor or factors necessary for optimum chick growth. The factor appears to have rather wide distribution, being present in corn, soybean oil meal, etc. It appears to be 5-7 times as concentrated in fish meal as in corn, and 2-3 times as concentrated as in soybean oil meal. It appears to be of about equal concn. in fish meal and 50% solids fish solubles. Sugar diets have been used to study the factor.—*H. L. Wilcke.* (Biological Abstracts)

BLAYLOCK, L. G., L. R. RICHARDSON, and C. M. LYMAN. (Texas Agric. Expt. Sta., College Station, Tex.)
STUDIES WITH CHICKS RECEIVING SUBOPTIMUM AMOUNTS OF [B] VITS. WITH AND WITHOUT ANTIBIOTICS. *Fed Proc. 11(1):* 437. 1952.—*An abstract.* (Biological Abstracts)

BRIGGS, GEORGE M. (Natl. Inst. Health, Bethesda 14, Md.)
A REVIEW OF RECENT DEVELOPMENTS IN POULTRY NUTRITION: VITAMIN B_{12}, ANTIBIOTICS, AND NEW GROWTH FACTORS. *Trans. Amer. Assoc. Cereal Chemists. 10:* 31-50. 1952.—A review of these subjects is given including a discussion of the mechanism of growth-promoting action of antibiotics and other promotants in poultry nutrition. Emphasis is placed on the application of these newer developments to the feed industry: 159 refs. through Dec., 1951.—*G. M. Briggs.* (Biological Abstracts)

ELY, C. M. (Natl. Distillers Products Corp., Cincinnati, Ohio)
SURFACE ACTIVE AGENTS AS GROWTH STIMULATORS IN CHICK RATIONS. *Feedstuffs 24(16):* 24, 26, 28, 46-50. 1952.—Lauryl ethylene oxide condensate, when added at the rate of 2.2 lbs. per ton to a basal diet fortified with animal protein supplements, produced growth increases of 4.5 to 8.9% (averaging 7.1%) over the control lots of chicks at broiler age (probably 10 wks.) This was a Connecticut type ration. In some field tests, the avg. increase in rate of growth of broilers at 10 weeks was 4.7%. No antibiotics were used in these diets. LEOC was less effective with all-vegetable diets. Approx. twice as much of the material was needed for best results in all-vegetable diets. Optimum feeding levels were 2.2 lbs. per ton in all-vegetable type diets and 1.1 lbs. per ton in animal protein supplemented diets. There was no growth improvement at 5 or 6 weeks of age, but these increases appeared during the last 4 to 6 weeks of the trials. This suggests to the author that the effect of the material is due to more rapid or more complete absorption in the intestinal tract. Levels as high as 1% did not affect mortality, but growth was not increased as much as at lower levels. In comparison with antibiotics, the average growth response was slightly superior with surfactants, but feed efficiency showed slight differences in favor of antibiotics. In one test, a combination of LEOC and antibiotic produced about the same results as either alone. LEOC did not produce increased gains when added to all-vegetable type rations supplemented with B_{12}. B_{12} and antibiotic combinations produced growth superior to that of LEOC alone, and there was no advantage in adding LEOC to the B_{12}-antibiotic combination. In further tests at the 1.1 lb. per ton level, alkyl amines and

sorbitan monostearate failed to produce growth responses. Alkyl amides, alkyl sulfates, sodium alkyl sulfate, sodium alkyl sulfo amine, sodium ethylene diamine tetraacetic acid, pentaerythrital monostearate, and a protein condensation product (chem. comp. unknown) produced growth responses of between 2 and 5%. Alkyl phosphoric ester, alkyl polyethylene oxide, sodium alkyl phosphonate, sodium alkyl aryl sulfonate, sodium alkyl sulfo amide, and quaternary ammonium salts all gave responses greater than 5%. The 4 types, alkyl aryl sulfonates, sodium ethylene diamine tetraacetic acid, the quaternary ammonium compounds, and the alkyl polyethylene oxides appeared to be superior. Commercial laundry products were also effective.—*H. L. Wilcke.* (Biological Abstracts)

GRAU, C. R. (Poultry Husbandry Dept., U. California, Berkeley.)
FISH PROTEINS AS AMINO ACID SOURCES FOR ANIMAL FEEDING. *Feedstuffs 24(21):* 12, 56-57. 1952.—Fish meal may be used with vegetable proteins to supply methionine, lysine, and tryptophan, as well as other amino acids. Protein quality may be determined by (a) determining amino acid content by chemical and/or microbiological analyses; (b) arbitrary chemical or biological tests, such as digestibility; (c) the material may be fed to determine the rate of growth of animals under standard conditions. Almost 40% of the fish meals tested have been unsatisfactory protein sources. Total protein is no indication of protein quality.—*H. L. Wilcke.* (Biological Abstracts)

HALBROOK, E. R. (Montana State Coll., Bozeman.)
VITAMIN B_{12} SYNTHESIS IN LITTER. *Flour and Feed 52(12):* 12. 1952.—Chicks may sho wmore rapid growth on "built up" litter than on litter that is frequently changed. This is due to accumulations of molds, yeast, and bacteria, which are responsible for synthesis of nutritional factors such as vitamin B_{12}.—*M. J. Blish.* (Biological Abstracts)

HEYWANG, BURT W. (U.S. Dept. Agric., Glendale, Arizona), **H. R. BIRD** (U.S. Dept. Agric., Beltsville, Md.) **and R. P. KUPPERMAN.** (U.S. Dept. Agric., New Orleans.)
THE LOSS OR INACTIVATION OF PURE GOSSYPOL IN A MIXED DIET. *Poultry Sci. 31:* 35-39. 1952.—Pure gossypol mixed in a laying mash at levels of 0.012, 0.024 or 0.036% could not be detected 6 days after mixing by either chemical or biological tests. The biological test consisted of feeding laying pullets and observing egg wt. and hatchability. These were not affected if the gossypol-containing feed was held 6 days before feeding. Pure gossypol freshly mixed in the feed at the 2 higher levels depressed egg wt. and hatchability.—*H. R. Bird* (Biological Abstracts)

HEUSER, G. F. (Cornell U., Ithaca, N. Y.)
ANTIBIOTICS FOR POULTRY. *Flour and Feed 52(8):* 38. 1952.—Antibiotics have increased the early (2-4 weeks) growth rate as much as 25% for turkeys, while for chickens the corresponding increase is 10-15%. Response to antibiotics becomes greater as the quality of the ration decreases.—*M. J. Blish.* (Biological Abstracts)

HILL, C. H., and R. BORCHERS. (Univ. Nebraska, Lincoln.)
GROWTH RETARDING EFFECT OF UNHEATED SOYBEANS [IN CHICKS]. *Fed. Proc. 11(1):* 446. 1952.—*An abstract.* ....

HILL, F. W. and L. M. DANSKY. (Cornell U., Ithaca, N. Y.)
DIET'S EFFECT ON CHICKENS' BODIES. *Feed Bag(12):* 53-54. 1951.—A high-energy type diet was diluted with varying levels of oat hulls, keeping the protein level constant at approx. 20%. The chicks were essentially the same weight at 6 and 11 wks. when diets containing 0, 10, 20, 30, and 40% oat hulls were fed ad libitum, but the fat content of the males was considerably lower at the higher levels of oat hull intake. Total caloric intake decreased with increasing amts. of oat hulls in the rations.—*H. L. Wilcke.* (Biological Abstracts)

JUKES, THOMAS H. (Lederle Labs., Pearl River, N. Y.)
FACTORS INVOLVED IN UTILIZATION OF HOMOCYSTINE BY CHICKS. *Fed. Proc. 11(1):* 447. 1952.—*An abstract.* (Biological Abstracts)

KENT, O. B. (Quaker Oats Co., Chicago, Ill.)
RESTRICTED FEEDING PROGRAM. *Amer. Egg and Poultry Rev. 14(3):* 20, 22. 1952.—Pullets raised for egg production on the restricted feed plan need only about 20 lb. of feed compared to an avg. of 34 lbs. on the usual full-feed grain and mash plan. The restricted diet calls for moderate 5 days a week feeding of oats and mash and the other 2 days oats only. Stronger and healthier birds, with less trouble from cannibalism and feather-picking, are obtained. They start laying later but lay larger eggs, more consistently, and for a longer time.—*H. G. Lindquist.* (Biological Abstracts)

KRAMKE, E. H., M. D. LLOYD, and J. C. FRITZ. (The Borden Co., Elgin, Ill.)
SOME FACTORS WHICH AFFECT UTILIZATION OF VITAMIN A. *Poultry Sci. 31:* 49-53. 1952.—Chicks and turkey poults were used to study various factors which influence the utilization of vit. A. Vit. A dry supplements were found to be more effective than usual assay methods would indicate. This was attributed to loss of potency when the reference oil was added to the basal ration. When a suboptimal level of vit. A activity was furnished in the form of alfalfa meal, chick growth was stimulated by adding crude soybean lecithin, defatted lecithin, or crude soybean oil to the ration. Addition of tocopherol or methylating agents had much less effect upon utilization of the vit. A activity. Addition of wheat germ oil to the basal ration permitted turkey poults to utilize carotene more efficiently for growth. Preformed vit. A was well utilized under the conditions of the test without the addition of wheat germ oil to the ration. Essentially optimum growth of turkey poults was obtained with 2250 U.S.P. units of vit. A activity regardless of whether the source of the vit. A activity was vit. A alcohol, natural vit. A esters, synthetic vit. A palmitate, or carotene supplied by alfalfa or an oil soln. —*Authors.* (Biological Abstracts)

MACHLIN, L. J., C. A. DENTON, W. L. KELLOGG, and H. R. BIRD. (U. S. Dept. Agric., Beltsville, Md.)
EFFECT OF DIETARY ANTIBIOTIC UPON FEED EFFICIENCY AND PROTEIN REQUIREMENTS OF GROWING CHICKENS. *Poultry Sci. 31:* 106-109. 1952.—The protein requirement for the growth of chickens to 6 wks. of age appeared to be decreased slightly by addition of aureomycin to a corn-soybean oil meal diet. Aureomycin stimulated growth most effectively when added to diets containing 19% protein. It was less effective with lower levels. The antibiotic increased efficiency of feed utilization at all protein levels (15-25%), but the effect was more pronounced with increasing protein levels.—*L. J. Machlin.* (Biological Abstracts)

MACHLIN, L. J., C. A. DENTON, and H. R. BIRD. (U. S. Dept. Agric., Beltsville, Md.)
SUPPLEMENTATION WITH VITAMIN B_{12} AND AMINO ACIDS OF CHICK DIETS CONTAINING SOYBEAN OR COTTONSEED MEAL. *Poultry Sci. 31:* 110-114. 1952.—Simple corn-soybean oil meal and corn-cottonseed meal diets were assayed microbiologically for all amino acids considered essential for the chicken. When compared with recommended allowances, the soybean diet was found to be deficient in methionine and borderline in tryptophan and glycine. The cottonseed meal diet was deficient in lysine and methionine and borderline in glycine, tryptophan and tyrosine (sum of tyrosine and phenylalanine). These amino acids were tested by growth expts. with chicks reared to 6 wks. of age. The only amino acids found deficient by chick assay were methionine on the soybean diet and lysine on the cottonseed meal diet.

Chicks from vit. B_{12}-depleted dams required both B_{12} and methionine for a max. response when fed the soybean diet, whereas there was little or no increase in growth when B_{12} was added to the cottonseed meal diet with or without supplementary lysine. Addition of an aureomycin fermentation product, however, did increase growth of chicks fed the cottonseed meal diet.—*L. J. Machlin.* (Biological Abstracts)

MACHLIN, L. J., C. A. DENTON, P. B. PEARSON, and H. R. BIRD. (Bureau Animal Industry, U. S. Dept. Agric., Beltsville, Md.)
SYNTHESIS OF CYSTINE FROM INORGANIC SULFATE BY THE HEN. *Fed. Proc. 11(1):* 448-449. 1952.—*An abstract.* (Biological Abstracts)

MACHLIN, L. J., A. H. LANKENAU, C. A. DENTON, and H. R. BIRD. (U.S. Dept. Agric., Beltsville, Md.)
EFFECT OF VITAMIN B_{12} AND FOLIC ACID ON GROWTH AND URICEMIA OF CHICKENS FED HIGH LEVELS OF GLYCINE. *Jour. Nutrition 46:* 389-398. 1952.—Addition of 3, 6 or 9% glycine to vit. B_{12}-deficient diets caused a growth depression and increased mortality in growing chickens from vit. B_{12}-depleted dams. Both vit. B_{12} and folic acid functioned in counteracting this toxicity, although B_{12} was somewhat more effective. When both of these vitamins are adequately supplied, the chickens tolerate up to 6% glycine. Addition of 6 or 9% glycine to the diet increases the blood uric acid levels. Folic acid tends to decrease these high levels of uric acid in the blood. Vit B_{12} tends to increase the level of uric acid in the blood of young chickens.—*Courtesy Wist. Bibl. Serv.*

MARCH, B., and JACOB BIELY. (U. British Col., Vancouver, B.C.)
THE EFFECT OF FEEDING AUREOMYCIN ON THE BACTERIAL CONTENT OF CHICK FECES. *Poultry Sci. 31:* 177-178. 1952. —Bacterial counts were made on the feces of chicks fed rations with and without aureomycin supplementation. High levels of aureomycin depressed the numbers of total aerobic, lactic acid and coliform bacteria. Low levels of aureomycin lowered the numbers of lactic acid bacteria without affecting the total aerobic or coliform count. Growth response with the different levels of aureomycin was similar.—*Authors.* (Biological Abstracts)

MARIAKULANDAI, A., THAN MYINT, and JAMES McGINNIS. (State Coll., Washington, Pullman.)
EFFECT OF TERRAMYCIN AND VITAMIN B_{12} ON HATCHABILITY. *Proc. Soc. Exptl. Biol and Med. 79:* 242-244. 1952.—An expt. was conducted with White Leghorn pullets to determine the effect of feeding terramycin alone and in combination with vit. B_{12} on egg production and hatchability. The results obtained indicate that terramycin had little or no effect on egg production and gain in wt. In the absence of vit. B_{12}, hatchability of fertile eggs was improved by feeding terramycin. There was an indication that terramycin fed in combination with vit. B_{12} further improved hatchability.—*Authors.* (Biological Abstracts)

McGINNIS, JAMES. (Washington State Coll., Pullman.)
STUDY FAILS TO GIVE ADDITIONAL INFORMATION ON LEG WEAKNESS. *Feedstuffs 24(18):* 25. 1952.—Penicillin did not affect the incidence of leg weakness in turkeys, nor did dried brewers' yeast, dried whey, alfalfa, or fish liver oils. The problem of leg weakness in turkeys has not been solved.—*H. L. Wilcke.* (Biological Abstracts)

McGINNIS, J., L. R. BERG, and H. SAXENA. (State Coll. Washington, Pullman.)
UNIDENTIFIED GROWTH FACTORS FOR CHICKS. *Fed. Proc. 11(1):* 450-451. 1952.—An abstract. (Biological Abstracts)

McGINNIS, J., L. R. BERG, JOEL R. STERN, M. E. STARR, R. A. WILCOX, and J. S. CARVER. (State Coll. Washington, Pullman.)
ADDITIONAL EVIDENCE FOR AN UNIDENTIFIED GROWTH FACTOR FOR TURKEYS AND CHICKS. *Poultry Sci. 31:* 100-106. 1952.—Expts. were conducted to study the effects of animal products such as fish meal, fish solubles, liver meal and dried whey on growth of chicks and turkey poults fed different types of rations. A combination of terramycin with whey and liver L gave a greater growth response than any of the supplements alone. The use of a purified soybean protein as a substitute for soybean oil meal failed to amplify the deficiency of an unidentified growth factor for the chick. The addition of vitamin-free casein or amino acids (methionine, lysine and tryptophan) to the basal diets failed to give growth response. Even though there were wide differences in the response to fish solubles added to the different soybean oil meals, these differences were of no significance, since the interaction between meals and solubles was not statistically significant.—*J. R. Stern.* (Biological Abstracts)

McGINNIS, JAMES, and J. R. STERN. (Washington State Coll., Pullman.)
ANTIBIOTICS IN TURKEY NUTRITION. *Feedstuffs 24(10):* 20-26, 48. 1952.—Bacitracin produced a marked increase in growth of turkey poults when fed at the 5 and 10 ppm. levels, but not as much as procaine penicillin at a 5 ppm. level. Pharmaceutical grade bacitracin produced maximum response at 5 ppm. Only slight responses were produced by neomycin, and tyrocidin at 5 ppm., and actidione decreased body weights. Diamine penicillin produced good growth responses at 2, 5 and 10 ppm. levels. Tyrothricin, acriflavin, crystal violet and gramicidin produced very little, if any, effect. In protein level studies, using procaine penicillin as the antibiotic, max. gains were obtained at 27-29% protein, either with or without the antibiotic, indicating that the antibiotic had no effect upon protein requirements of turkey poults. The response to penicillin appeared to be independent of the riboflavin content of the diet, but the antibiotic did change the dietary requirement for riboflavin, producing max. growth response with lower levels of riboflavin in the presence of antibiotic. When penicillin was withdrawn from the diet of the poult at various ages, the growth-stimulating effect persisted through the 4 week period of the tests, but the order of magnitude increased as the penicillin was retained in the diet. Increasing levels of diamine penicillin from 2 to 50 ppm. or of bacitracin from 5 to 50 ppm. did not increase growth rate, although terramycin did produce a slightly better response at the 50 ppm. level. Diamine and procaine penicillin are rated essentially equal in producing growth response for turkeys, with bacitracin intermediate between these forms of penicillin and terramycin. —*H. L. Wilcke.* (Biological Abstracts)

MILLER, CAREY D. (U. Hawaii, Honolulu.)
NUTRITION EXPERIMENTS WITH CHICKS. A DEMONSTRATION TO SHOW SCHOOL CHILDREN THE EFFECTS OF GOOD AND POOR DIETS USING HUMAN FOODS. *Hawaii Agric. Expt. Sta., Progress Notes 74:* 1-5. 1951.—Detailed instructions are given for conducting demonstration expts. with chicks using human foods. Designed for schools or for other groups interested in nutrition. Food needs of chicks and humans are discussed briefly. Results of feeding 2-week-old chicks good and poor diets for 2 weeks, using white and brown rice as the basic foods, are illustrated. Reversing the diets after 2 weeks is recommended.—*C. D. Miller.* (Biological Abstracts)

MONROE, R. A., H. PATRICK, C. L. COMAR, and O. E. GOFF. (Tennessee Agric. Expt. Sta., Knoxville).
METABOLISM OF VITAMIN B_{12}. 1. THE COMPARATIVE EXCRETION AND DISTRIBUTION IN THE CHICK OF Co^{60} AND VITAMIN B_{12} LABELLED WITH Co^{60}. *Poultry Sci. 31:* 79-84. 1952.—The distribution of intraperitoneally administered Co^{60} in chicks was in general agreement with the values reported by other workers with the exception of the liver which was much lower. Co-labeled-vit. B_{12} was retained to a greater extent than Co^{60} as evidenced by lower ex-

cretion and, in general, higher concn. values in the tissues. Moreover, the turnover rate of vit B_{12} appeared to be slower than that of inorganic Co, especially in the spleen.—*C. L. Comar.* (Biological Abstracts)

OLIVARES, EMILIA O.

COMPARATIVE EFFECTS OF GROWTH FACTOR IN COW MANURE AND OF PARVO (LEDERLE) ON THE DEVELOPMENT OF CHICKENS. *Philippine Jour. Animal Indust. 11:* 3-19. 1950. —Half saturated $(NH_4)_2SO_4$ precipitate using 50% ethyl alcohol as solvent for extract of cow manure fed to chicks at rate of 75 ppm. of the diet produced faster growth and mortality was less than similar groups of chicks fed Parvo in the proportion of 2 ppm. Optimum growth was observed when 35 ppm. of the solute, and also when 75 ppm. of the precipitate was added to ordinary poultry ration. There was no pronounced effect from the supplement on egg production or hatchability.—*W. A. Craft.* (Biological Abstracts)

OLSSON, NILS, GUSTAF KIHLEN, AKSEL RUUDVERE, CARL WADNE, and GÖSTA ANSTRAND.

SMALTBARHETSFORSOK MED FJADERFA. DIGESTIBILITY EXPERIMENTS WITH POULTRY. *K. Lantbrukshogskolan Statens Husdjursforsok, Meddel. 43:* 5-67. 1950.—This report concerns 83 digestibility expts. with chickens and 10 comparative digestibility expts. with chickens, geese, and turkeys. The Edin Indicator Method, using chromic oxide, was used. In the use of common feeds with chickens, passage through the alimentary canal was complete in 24 hrs. The avg. digestibility coeff. of organic matter varied between 40.9 and 100.8, depending on the chem. composition of the feeds. The digestibility coeff. of crude protein varied between 59.8 and 99.9 as compared with 42.3 and 99.8 for pure protein. The digestibility coeff. of N-free extract varied between 11.6 and 98.4, depending upon the fiber content of the dry matter. Most of the expts. gave a negative digestibility coeff. for fiber, indicating that chickens have little capacity for digesting this constituent. The number of animals used in the 10 comparative digestibility expts. with chickens, geese, and turkeys was too small for dependable conclusions. A statistical study of the results of previous expts. indicated that the digestibility coeff. of protein depended partly on the method used for the detn. of fecal-N. The digestibility coeff. of protein increased with an increasing amt. of dry matter up to 28%; above this it tended to decrease. The digestibility of ether extract was highest when the amt. in the dry matter was about 11%. The digestibility coeff. of organic matter decreased with increasing fiber content in the dry matter.—*E. P. Johnson.* (Biological Abstracts)

PARTHASARATHY, D., and S. G. IYER. (Indian Vet. Res. Inst., Izatnagar.)

PROTEINS FOR EGG PRODUCTION. *Indian Jour. Vet. Sci. and Animal Husbandry 20:* 105-111. 1950.—Five groups of R.I. Red pullets were fed, respectively: (1) basal mash containing wheat bran 25, yellow maize 35, oats 15 and jowar 25 parts; (2) 20 parts rape cake supplemented with (1); (3) 15 parts peanut meal with (1); (4) 16 parts fish meal and 84 parts (1); and (5) basal mash with 1.0-1.1 oz. meat offal per bird per day. In addition broken limestone and water were given ad lib. Egg production was maximum from the 5th to 10th weeks; the avg. output of eggs in 12 weeks exptl. period in the five groups being 16.9, 33.2, 27.3, 31.1, and 34.4; while the number of lbs. of food consumed for producing 1 egg was 1.26, 0.69, 0.81, 0.73 and 0.62, respectively. No significant difference in the egg size was observed.—*N. N. Dastur.* (Biological Abstracts)

PETERSEN, C. F., A. C. WIESE, R. V. DAHLSTROM, and C. E. LAMPMAN. (U. Idaho, Moscow.)

INFLUENCE OF VITAMIN B_{12} AND ANTIBIOTICS ON HATCHABILITY. *Poultry Sci. 31:* 129-132. 1952.—96 White Leghorn hens were grouped into 6 lots and fed an all-plant basal diet until hatchability of fertile eggs was low. Lot 1 was then continued on the basal diet. Lots

2,3,4 and 5 were injd. with crystalline vit. B_{12} at levels of 0.5, 1.0, 2.0, and 4.0 μg./hen/wk. Lot 6 was fed 3% fish meal. After 8 wks. the supplements were discontinued. The rate of decline in hatchability was in relation to the amt. of vit. B_{12} administered. B_{12} injn. levels of 0.5 and 1.0 μg. for 8 wks. resulted in very little transfer to eggs. Within 2 wks. after the injns. were discontinued, hatchability was reduced to its former level. 4μg./hen/wk. for 8 wks. permitted storage sufficient to maintain fair hatchability for a period of 6 to 7 wks. Fish meal at 3% permitted, after its removal from the diet, 77.2% hatch for a period of 20 wks. Aureomycin and streptomycin did not improve hatchability when fed at 50 mg./kg. to hens depleted in body storage of vit. B_{12} either in a vit B_{12}-deficient diet or one containing a sub-marginal level of 0.75 μg. B_{12} per kg. —*Authors.* (Biological Abstracts)

RIGDON, R. H. (U. Texas Medical Branch, Galveston.)
PATHOLOGICAL LESIONS IN THE NERVOUS SYSTEM OF THE DUCK FED A RATION DEFICIENT IN VITAMIN A. *Arch. Pathol. 53:* 239-249. 1952.—The pathologic changes occurring in young ducks fed a vit.-A-deficient ration are found primarily in the nerve cells of the spinal cord and the spinal root ganglia. These changes are characterized by pyknosis and complete degeneration of the nerve cells in the spinal root ganglia and in both the anterior and posterior horns of the spinal cord. Few petechiae are present in the gray substance of the cord. The vertebral column was carefully examined to see whether the osseous tissue had compressed the cord. Such pressure was not demonstrated. Foci of cartilage and bone and large hemorrhages also were not present in the central nervous system of these ducks; however, they were fed the same vit. A-deficient ration as was used previously by Fletcher and Rigdon. The explanation of this variation in the occurrence of lesions in ducks is not known.—*R. H. Rigdon.* (Biological Abstracts)

SAVAGE, J. E., C. W. TURNER, H. L. KEMPSTER, and A. G. HOGAN. (U. Missouri, Columbia.)
THE EFFECTS OF VITAMIN B_{21} AND THYROPROTEIN ON EGG PRODUCTION, EGG WEIGHT, SHELL QUALITY AND HATCHABILITY. *Poultry Sci. 31:* 22-31. 1952.—One group of White Leghorn pullets received a basal plant ration which contained soybean oil meal as the only protein supplement. One modification of this diet was obtained by the addition of 5 members of the vit. B complex, and a 2d modification was obtained by the addition of these same vitamins with a vit. B_{12} concentrate. Each of these 3 diets was modified by the addition of thyroprotein (Protamone). A 7th ration contained animal portein concentrates, and the 8th was obtained by adding thyroprotein to the 7th. The 1st year egg production was practically the same on all rations and the decline in summer egg production was not retarded by thyroprotein. This hormone had no effect on egg weight, but there was some evidence that it increased shell strength. Vit. B_{12} raised appreciably the hatchability of the eggs when the hens consumed an all plant ration, but it was not as effective as the animal proteins. The pullets that consumed thyroprotein had lower body wts. than did their controls.—*A. G. Hogan* (Biological Abstracts)

SCOTT, M. L.
ENLARGED HOCK STUDY. *Amer. Egg and Poultry Rev. 12(6):* 16. 1951.—No exptl work is given. It is concluded that enlarged hock disorder in turkeys is due to feeding fish liver oil, which reduces the creatine level in the muscles, thus causing the turkeys to become weak and crippled. Feeding dried brewers' yeast or certain methylating compounds prevents the disease.—*H. G. Lindquist.* (Biological Abstracts)

SCOTT, M. L. (Cornell U., Ithaca, N. Y.)
EFFECT OF DRIED DISTILLERS' SOLUBLES, WHEY AND LACTOSE UPON ENLARGED HOCKS IN TURKEYS. *Poultry Sci. 31:* 175-176. 1952.—Evidence is presented showing that samples of whey products in which a part of the lactose had been removed were more effective in preventing the enlarged hock disorder and promoting growth

in turkey poults than were samples of whole dried whey. The results indicated that lactose is not well tolerated by young turkeys. Distillers' dried solubles were shown to be a fair source of the factor required for prevention of enlarged hocks as well as the factor required for growth. —*M. L. Scott.* (Biological Abstracts)

SINGSEN, E. P. (U. Connecticut, Storrs.)
PRESENT TRENDS IN BROILER NUTRITION. *Amer. Egg and Poultry Rev. 12(9):* 82, 84, 86, 88. 1951.—The recent work on the use of antibiotics in chick and turkey starting rations is reviewed as is the use of vitamin B_{12} in poultry rations.—*H. G. Lindquist.*

SINGSEN, E. P. (U. Connecticut, Storrs.)
TRENDS IN BROILER NUTRITION. *Flour and Feed 52(9):* 28-29. 1952.—Factors influencing growth response of young chicks to antibiotics are individually discussed. Vit. B_{12} should be available in the amt. of 3-6 mg. per ton of ration. Reports that plant protein supplemented with B_{12} can promote growth equal to that obtained with animal protein have not been substantiated, and some animal protein (2.5-5% fish meal) is needed for best results. Methionine supplementation is effective when the ration contains no fish meal, but its response is negligible when the diet contains 5% fish meal.—*M. J. Blish.* (Biological Abstracts)

SINGSEN, E. P., and L. R. MATTERSON. (U. Connecticut, Storrs.)
EXPERIMENTS WITH HIGH EFFICIENCY BROILER RATIONS. *Feedstuffs 24(18):* 30, 32, 82. 1952.—When no antibiotics are fed, there is a progressive increase in the wt. of broilers when the protein level of the ration is increased from 18% through 22%, and a slight drop at 24%. When aureomycin was fed at a level of 9 g. per ton of feed, there was an increase in the rate of growth with increasing protein, including the 24% level, but gains above the 21% level of protein were not significant. There was also an improvement in feed efficiency with increasing protein levels. The addition of 5% of alfalfa meal resulted in a slight decrease in rate of growth, and this effect was more pronounced at the 20% protein level than at 18%. Wheat gray shorts showed little effect on rate of growth until the amt. used exceeded 10% of the ration. Fish meal additions to all plant rations increased rate of growth with or without antibiotics (bacitracin) and most of the effect is obtained with 2.5% of fish meal. Bacitracin produced increases in rate of growth at the 5, 10, and 20 g. per ton levels when chicks were kept in batteries, but the 10-g. level appears to be the maximum required for economical returns in rate of growth response. However, there was no response from the antibiotic when the chicks were brooded on the floor. The response to antibiotics is not consistent.—*H. L. Wilcke.* (Biological Abstracts)

SLINGER, S. J., A. E. FERGUSON, and J. D. McCONACHIE. (Ontario Agric. Coll., Guelph, Canada.)
A CARRY-OVER EFFECT OF PENICILLIN FROM DAM TO PROGENY. *Poultry Sci. 31:* 172-174. 1952.—Chicks from hens fed vegetable-type diets adequate in known respects and containing penicillin grew more rapidly than those from hens fed similar diets and no antibiotic. In spite of the fact that the chicks themselves were fed penicillin, the maternal influence was still apparent at 10 wks. of age. A possible explanation of this effect is that, under the influence of penicillin, an unknown component(s) of the animal protein factor complex is synthesized in the intestinal tract of the hen, is then deposited in the egg and utilized by the developing chick.—*S. J. Slinger.* (Biological Abstracts)

SLINGER, S. J., W. F. PEPPER, and D. C. HILL. (Ontario Agric. Coll., Guelph, Canada.)
INTERACTION BETWEEN PENICILLIN AND GRASS JUICE CONCENTRATE IN TURKEYS. *Poultry Sci. 31:* 187-188. 1952.—Evidence is presented to indicate that the growth and feed efficiency responses of turkeys to grass juice concentrate are influenced by the presence or absence of penicillin in the diet. It is suggested that under the

influence of penicillin a factor(s) present in grass juice concentrate is (are) either synthesized in the intestinal tract or made more readily available to the poult.—*S. J. Slinger.* (Biological Abstracts)

SQUIBB, ROBERT L., and MIRIAM K. WYLD.
EFFECT OF COROZO PALM NUT OIL MEAL IN THE BABY CHICK DIET. *Poultry Sci. 31:* 118-122. 1952.—Oil meal from corozo palm nuts (probably *Orbignya cohune* and species of *Scheelea),* indigenous to American Tropics, when supplying up to 10% of the crude protein of baby chick diets, is superior to equivalent protein supplied by cottonseed and sesame oil meals. When fed in excess of 50% of ration, however, this meal depresses growth, lowers feed efficiency, and increases mortalities.—*T. E. Carlson.* (Biological Abstracts)

SZEPSENWOL, JOSEL, PHYLLIS L. STROBEL, and MARY HANSON PARTRIDGE. (Emory Univ. Sch. Med., Emory University, Ga.)
EFFECT OF VITAMIN B COMPLEX DEFICIENCY AND OF AMINO ACID DEFICIENCY ON CHICK LIVER ASCORBIC ACID. *Fed. Proc. 11(1):* 158. 1952.—*An abstract.* (Biological Abstracts)

TANAKA, J., A. L. PALAFOX, and M. M. ROSENBERG. (U. Hawaii, Honolulu 14.)
A COMPARISON OF THREE SOURCES OF CALCIUM FOR LAYING CHICKENS. *Hawaii Agric. Expt. Sta. Prog. Notes 68:* 1-7. 1951.—Rations containing either oyster shell, crushed coral, or Kalkar differed widely with respect to the pullet's ability to deposit egg shell. Whereas pullets fed oyster shell rquired 2.9 parts of Ca of total diet to deposit 1 part of Ca in the egg shell, crushed coral required 62.8% and Kalkar 30.7% more Ca. Similarly, when the efficiencies of Ca utilization of the supplements alone were compared, in which only laying birds were considered, it was then calculated that 53.5% more Ca was needed when crushed coral was fed, and 58% more was required when Kalkar served as the supplemental source of Ca. However, all 3 sources of supplemental Ca served well in supplying Ca for egg production. There was no real difference between the groups when comparisons were made on egg production, egg size, shell wt., shell thickness, specific gravity, and the frequency of either cracked or soft-shelled eggs. It would appear, therefore, that the primary considerations upon which the poultryman need base his decision are price and availability.—*M. M. Rosenberg.* (Biological Abstracts)

YACOWITZ, H., C. H. HILL, L. C. NORRIS, and G. F. HEUSER. (Cornell U., Ithaca, N. Y.)
DISTRIBUTION OF VITAMIN B_{12} IN THE ORGANS AND TISSUES OF THE CHICK. *Proc. Soc. Exptl. Biol. and Med. 79:* 279-280. 1952.—A study was made of the distr. of vit. B_{12} in the tissues and organs of chicks fed a purified diet containing a high level of the vitamins. Vit. B_{12} content was determined by microbiological assay using *Lactobacillus leichmannii* ATCC 4797. Kidney was found to contain the most vit. B_{12}, but liver and pancreas were also found to be good sources of the vitamin. The proventriculus, testes, heart, adrenals, spleen, gall bladder, thyroid and thymus contained appreciable quantities of the vitamin. Muscle tissue, except for the heart, was low in vit. B_{12}. A comparison of the results obtained by these authors with other published data indicates that certain organs, particularly the kidney, liver and pancreas have the ability to store appreciable quantities of vit. B_{12}.—*Authors.* (Biological Abstracts)

YACOWITZ, H., R. F. MILLER, L. C. NORRIS, and G. F. HEUSER. (Cornell U., Ithaca, N. Y.)
VITAMIN B_{12} STUDIES WITH THE HEN. *Poultry Sci. 31:* 89-94. 1952.—An all-vegetable diet containing 25% protein resulted in more rapid depletion of vit. B_{12} reserves of Single Comb White Leghorn hens than a similar diet containing 16% protein. The vit. B_{12} requirement for normal hatchability in hens fed a 25% protein diet appeared to be not greater than 0.2 μg./100 g. of diet. Normal eggs were found to contain

much higher levels of vit. B_{12} than eggs from hens fed a diet deficient in this vitamin. Eggs from the same hen showed remarkable individuality with respect to their vit. B_{12} content. A close correlation was noted between the vit. B_{12} content of depleted hens' eggs and hatchability. The vit. B_{12} requirement of the embryo for normal hatchability was found to be approx. 2.5 μg./g. of yolk.—*Authors.* (Biological Abstracts)

POULTRY PRODUCTS AND MARKETING

BRANT, A. W., and H. L. SHRADER.
HOW TO MEASURE EGG I.Q. (INTERIOR QUALITY). *Amer. Egg and Poultry Rev. 12(11):* 28-30. 1951.—Emphasis is placed on the importance of determining the quality of a broken-out egg. The use of the U.S.D.A. chart, the Van Wagenen chart and the "Haugh Unit" method is explained.—*H. G. Lindquist.* (Biological Abstracts)

DENTON, C. A., W. L. KELLOGG, and H. R. BIRD. (Bureau of Animal Industry, U. S. Dept. of Agric., Beltsville, Md.)
THE APPARENT VITAMIN B_{12} CONTENT OF EGGS AS AFFECTED BY EXTRACTION IN THE PRESENCE OF CYANIDE. *Fed. Proc. 11(1):* 440. 1952.—*An abstract.* (Biological Abstracts)

GWIN, J. M. (U. Maryland.)
THE DIRTY EGG PROBLEM. *Amer. Egg and Poultry Rev. 14(2):* 16, 105-106, 1952.—Factors that have been studied and found to affect spoilage due to washing eggs are temp. of washing medium, time and conditions under which the eggs become infected, and failure to recognize spoilage as it appears slowly when eggs are in storage.—*H. G. Lindquist.* (Biological Abstracts)

GWIN, J. M. (U. Maryland, College Park.)
A REPORT OF PROGRESS ON THE SUBSCALDING METHOD OF DRESSING POULTRY. *Amer. Egg and Poultry Rev. 12(10):* 14, 73. 1952.—From exptl. work a temp. of 139° F is recommended for sub-scalding. At that temp. the thin outer layer of skin is loosened, so that it is completely removed, producing uniformly light colored birds that are easily picked and pinned.—*H. G. Lindquist.* (Biological Abstracts)

JORDAN, RUTH, BETTY NOBLE LUGINBILL, L. E. DAWSON, and C. J. ECHTERLING. (Purdue U., Lafayette, Ind.)
THE EFFECT OF SELECTED PRETREATMENTS UPON THE CULINARY QUALITIES OF EGGS FROZEN AND STORED IN A HOME-TYPE FREEZER. I. PLAIN CAKES AND BAKED CUSTARDS. *Food Res. 17:* 1-7. 1952.—Egg yolks and broken-out whole eggs, pretreated with 2 levels each of salt, sugar, and white corn sirup, then frozen and stored at about —18°C. in a home-type freezer for periods up to 6 months, retained to a high degree their functional properties necessary for satisfactory performance in plain cakes and custards. (Biological Abstracts)

ROSENBERG, M. M., and T. TANAKA. (U. Hawaii, Honolulu 14.)
CHANGES IN QUALITY OF EGGS PRODUCED IN HAWAII. *Hawaii Agric. Expt. Sta. Tech. Bull. 13:* 1-24. 1951.—In order to determine the effects of different methods and duration of storage on changes in egg quality, 4453 eggs were candled and then opened. Physical measurements were taken of the yolk and albumen, and indexes were calculated for each egg. These indexes were procured daily from 1 to 11 days of storage, and for eggs stored 31, 59, and 93 days. It was found that a fresh egg had a yolk mobility of 1.61 ± 0.023, a yolk index of 0.373 ± 0.014, and an albumen index of 0.549 ± 0.017. In every comparison, refrigerated eggs exhibited greater yolk-mobility changes than comparable room eggs. Furthermore, in every comparison, shell-treated eggs ex-

hibited greater yolk-mobility changes than non-shell-treated eggs. The data collected in this study suggest that shell treatment of eggs that are to be refrigerated 11 days or less is not warranted. The study on cold storage of market eggs also revealed there was no real benefit in shell-treating eggs that are stored 2 months or less. Shell-treated eggs stored for 93 days revealed a lower candling grade loss (0.27 grade) than the non-shell-treated controls, but these eggs contained 3.3% less thick albumen, and the albumen tended to be somewhat cloudy in appearance.—*M. M. Rosenberg.* (Biological Abstracts)

MANAGEMENT

BIRD, H. R. (U. S. Dept. Agric., Beltsville, Md.)
BROILERS LOOK AHEAD—HOW EFFICIENT CAN THEY GET. *Amer. Egg and Poultry Rev. 14(2):* 20, 110-111. 1952.—Methods suggested for reducing feed requirements per lb. gain in broilers are: improved feed formulas, improved strains of broiler chickens, better management and working with lights such as maintaining one hour of light followed by 3 hrs. of darkness.—*H. G. Lindquist.* (Biological Abstracts)

HALBROOK, E. R. (Montana State College, Bozeman.)
BUILT-UP LITTER AND ITS EFFECTS ON HATCHABILITY AND CHICK GROWTH. *Amer. Egg. and Poultry Rev. 12(9):* 30, 32, 112. 1951.—From work done by the author at Ohio State U. in 1948-1950 it is concluded that built-up litter saves labor and litter material, and improves hatchability, chick growth, and livability when a deficiency of vitamin B_{12} exists.—*H. G. Lindquist.* (Biological Abstracts)

STAFFE, A. (U. Bern, Switzerland.)
BELICHTUNG UND LEGELEISTUNG BEIM HUHN. [ILLUMINATION AND EGG PRODUCTION IN HEN.] *Experientia 7(10):* 399-400. 1951.—The increase of egg production in laying hens during winter induced by continuous illumination can also be induced by a single shock lighting. This can be done by applying a 1500 w. lamp twice daily at 4 and 4:45 a.m. for 20 sec. each time. Since the animals remain sitting on their roosts, the increase in egg production must be due to a direct influence of light via the optic nerve or some cutaneous receptors. The relationship between gonadotropic hormones of the anterior lobe of the hypophysis, blood sugar level and the ovary is discussed briefly.—*Auth. summ.* (Biological Abstracts)

WILSON, WILBUR O., and LEROY C. KLEIST. (U. California, Davis.)
METHODS OF BROODING CHICKS. *California Agric. 6(3):* 11, 14. 1952.—The advantages and disadvantages of infrared lamps in comparison with conventional electric brooding, are discussed.—*G. W. Bohn.* (Biological Abstracts)

GENERAL

CHRISTENSEN, RAYMOND P., and RONALD L. MICHELL.
INTERREGIONAL COMPETITION IN THE PRODUCTION OF CHICKENS AND EGGS. *U. S. Dept. Agric. Tech. Bull. 1031(7):* 1-62. 1951.—The N. Atlantic and Pacific regions are characterized by specialized poultry farms that have large flocks. In the North Central States, middle-sized flocks account for most of the chicken and egg production, usually as a supplementary enterprise. In the S. Atlantic and S. Central States most of the eggs come from small flocks having less than 100

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birds. Commercial broiler production is relatively concentrated in a number of specialized areas in several regions. The tenor of this analysis indicates that both demand and supply conditions will be significant, but that supply conditions may be relatively more influential in shaping the future map of the production of chickens and eggs. On the side of demand, a large part of the country can be regarded as a single market for eggs and chicken meat. Costs of transportation do not explain a very large part of interregional price differences. These are mainly related to variations in avg. grade and quality. In considering the supply factors that influence location, labor appears to be most controlling. Differences in prices for feed between regions are small and are partly offset by differences in prices of eggs and chickens. The growth of the broiler industry in widely separated areas, for example, follows a remarkably similar path, suggesting that differences in feed costs have not been very influential. Additional study is needed to furnish a satisfactory explanation of why broiler production has arisen in particular places rather than in other areas in which similar conditions apparently prevail. The availability of labor together with comparisons between its alternative uses appears to be one of the principal determinants of location. The poultry enterprise is flexible in terms of size, making it physically possible to use the free time of the farm operator and his family in a small sideline enterprise or to expand to a full-scale specialized commercial poultry farm. In either case, the real comparison is in terms of alternative uses for labor. The 2 areas that have had the most rapid rates of growth in recent years—southern New England and Minnesota—illustrate these 2 different lines of development. The forces of technology as applied to poultry are by no means spent. If market outlets become available, further expansion of both eggs and chicken meat may take place. The geographic pattern that may evolve will depend in part on developments in alternative enterprises. If crop and livestock enterprises

offer better returns, there will be less expansion in poultry in the Midwest especially. On the other hand, programs to improve the quality of eggs produced in the Midwest and South will raise the average price received and improve their competitive position.—*Auth. summ.* (Biological Abstracts)

COMAR, C. L., O. E. GOFF, H. PATRICK, R. A. MONROE.

RADIOISOTOPES IN POULTRY RESEARCH. *Proc. Amer. Vet. Med. Assoc. 1950:* 266-273. 1950.—Little more than a good beginning has been made in the application of radioisotope technics to poultry research. Only with the element phosphorus have intensive biochemical studies been undertaken. The following studies are known to the writers to be underway or in the planning stage at various laboratories: metabolism of Ca^{45} and P^{32} in birds showing lesions of osteopetrosis, mineral metabolism in birds as a function of their tendency to produce thin or thick-shelled eggs, effect of environmental temp. on mineral metabolism, the physiology of nutrient transfer in the developing embryo metabolism of cobalt-labeled vit. B_{12}, the production of labeled anthelmintics and study of their mode of action, use of P^{32} to label the virus produced in an infected egg, and effects of hormones on mineral metabolism.—*Auth. summ.* (Biological Abstracts)

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